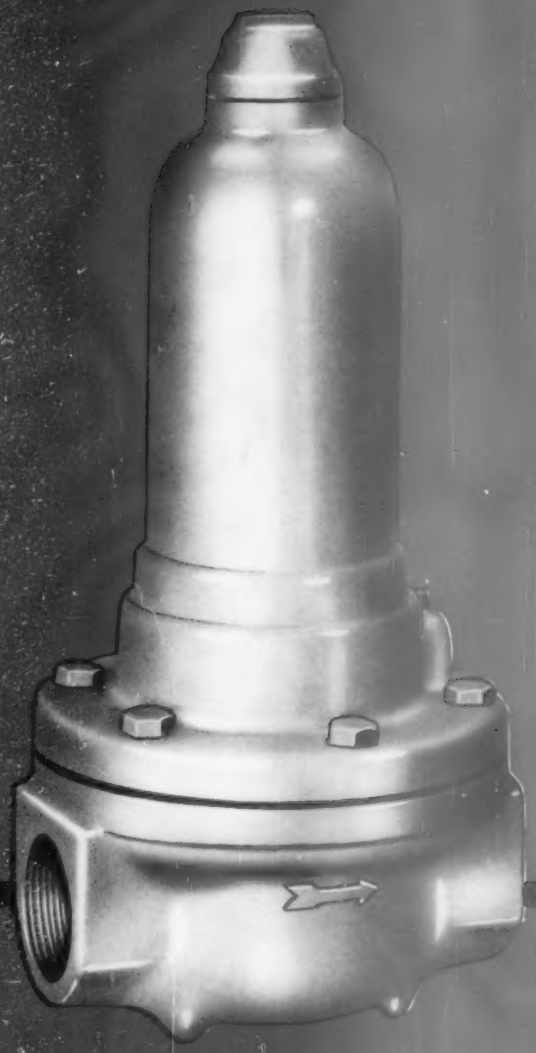
the OIL AND GAS JOURNAL
PUBLISHED WEEKLY April 18, 1960

Witt Stephens' policy of
"Anything to sell more gas"
has put Arkla Gas into orbit p.80

Restraint now will make 1960 a good year ▸ 75
Hunt drills hard rock at 20,000 ft. with 3¾-in. bit ▸ 78
Das Island: New source of Middle East oil ▸ 99
New light on compressor-cylinder cooling ▸ 138



HIGHEST SAFETY FACTOR—up to 1,500 psi shock load

HIGHEST OUTLET PRESSURE { up to 600 psi (¾-1-1¼") / up to 400 psi (1½-2")

ROCKWELL "141" FIELD REGULATOR

Sizes ¾" to 2" inclusive

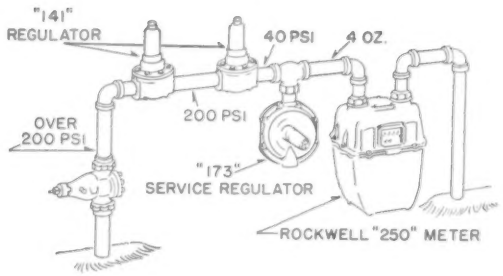
HOW TO CONTROL GAS AT 1000 psi . . . PLUS

This compact, sturdy "141" regulator offers the highest safety factor and utility in controlling gas at elevated pressures. It is service tested for 1000 psi at both inlet and outlet and designed to withstand shock loads of up to 1500 psi.

The convenience of interchangeable orifices and springs permits controlling outlet pressures within a 3 to 600 psi range. The same husky, large area diaphragm assembly is used for both low and high pressures. In any range, absolute zero lock up is obtained.

For installation security, the adjustment screw is guarded by a protective cap. With this construction you can even bury this regulator and pipe the vent above ground. Write for bulletin. Rockwell Manufacturing Co. Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ont.

HOW TO SERVE GAS TO FARM TAP CUSTOMERS



There are many opportunities to sell gas direct from high pressure lines. Farm tap service is one. Irrigation service is becoming equally important. The use of two "141" regulators for the primary cut provides a wide margin of safety while eliminating stress, valve abrasion and wire cutting.

HIGH PRESSURE REGULATORS

another fine product by

ROCKWELL

OIL AND GAS JOURNAL
Vol. 58, No. 16

Contents April 18, 1960

THE WEEK'S NEWS

General Interest:

Restraint Now Will Mean a Good Year in 1960 ... 75
Crude-Price Structure Remains Under Heavy Pressure ... 79
Arkla Gas Makes Aggressive Selling, New Ideas Pay Off ... 80
Oil Income Up, but Not as Much as Other Corporations ... 84
Spacing Headaches Add to Kansas Woes ... 86
(Last of a two-part series)
Energy Demand to Soar With Population Explosion ... 95

Pipelining:

Phillips Case Settlement May Come at Last ... 77
Pipeline Briefs ... 93

Processing:

Resid Quota Hassle Points Up Import Plan's Greatest Weakness ... 90
Gulf Goes to Court to Challenge Resid Quota Formula ... 90
Pilot-Plant Automation Developing Rapidly ... 94
Gas Exports Will Be Boon to Canada's Processing Industry ... 98
Independent Refiner Buys Exploration, Production Company ... 98
Processing Briefs ... 98

Foreign News:

Young Persian Gulf Field Due for Full-Scale Development ... 99
Caltex Has Inside Track on Big Algerian Concession ... 101
Bavaria Sets Up Commission to Study Pipeline Controversy ... 102
Japanese Finally Make Deal for Indonesian Fields ... 102

Drilling-Production:

Offshore Louisiana Well Is First Quintuple Completion ... 77
Small Bit Used to Drill Hard Formations in 20,000-Ft. Well ... 78
Summer Will Boost Rig Count in Alberta's Carstairs Area ... 93
Three Floods Planned in Three Zones of Oklahoma Field ... 95
New Method of Cutting Gas-Lift Well Costs Introduced ... 96

Exploration:

Important Strike Is First Oil for Texas' Delta County ... 173
Pennsylvania Oriskany Finds May Result in Second Look at Old Areas 174
March Multiple Completions ... 181
March Completions ... 200

REGULAR FEATURES

Advertisers' Index ... 215
Book Review ... 135
Calendar of Events ... 62
Classified Advertising ... 212
Drilling Contractors ... 169
Drilling Statistics ... 207
Editorial ... 73
Equipment Men ... 161
Exploration Highlights 173
Foreign News ... 99
Journally Speaking ... 71
Markets ... 210
New Equipment ... 151
On the Job—Pipelining 143
Personals ... 202
Production ... 208
Refining Statistics ... 209
Statistical Summary ... 206
Technical Questions ... 118
The Journal Said ... 71
They Say ... 59
Trade Literature ... 157
Watching Washington 91
Who's Who in Oil ... 202

Technology-Operation section on next page →

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TECHNOLOGY—OPERATION

Refining

Unicracking Upgrades Marginal Cracking Stocks 104
This is a new catalytic hydrocracking process developed by Union Oil Co. to convert catalytic cycle oils; thermal and coker gas oils; heavy cracked or straightrun naphthas; and high-sulfur, high-nitrogen virgin gas oils to high-quality gasoline and middle-distillate products.

Questions on Technology 118
Bibliography on underground storage; check on cost of carbon-black plants.

Questions and Answers on Coking, Distillation, and Treating 121
Here are portions of a discussion at a regional meeting of the Western Petroleum Refiners Association at El Dorado, Ark., at which experts answer questions on all phases of refining. Part 4 of 4 parts.

Production

Using Tandem Rod Pumps in Dual Completions 107
By M. C. Boyd
High costs make dual completions necessary. This presents no unusual problems except when both zones require artificial lift. Cities Service installed its first tandem-pump arrangement in 1956, and it is still in operation. Here is the story of this experience.

Gas-Well Stream Drives Small Generator 111
Lack of electricity has been a major stumbling block in the automation of some gas fields. Now the wells themselves can generate the power needed for their control.

Drilling

Electric Rig Offers Flexibility in Medium-Depth Drilling 112
By Ed McGhee
The new d.c. electric rig of Slats Honeymon Drilling Co. spudded its first well with only one of its two engines operating. Then it pumped, rotated, and pulled pipe with no difficulty until the surface hole had been made. This is the first standard electric unit in the medium-depth class.

Clay-Free Salt-Water Muds Save Time in West Texas Drilling 115
By B. J. Collings and R. R. Griffin
Field trials of this new mud show that it increases penetration rate, lengthens bit life, and costs no more than conventional low-viscosity muds. This promising fluid contains about 2% solids as compared to the 6 to 12% solids of conventional muds of the same weight.

Pipelining

Lab Studies Shed Light on Compressor-Cylinder Cooling 138
By F. W. Hartwick
Tests reveal qualitatively the thermodynamic trends to be expected from a normal compressor application. Use of this information should aid in the rational evaluation and selection of cylinder-cooling systems.

Polyethylene Pipe Means Low-Cost Jobs 143
By Leo B. Croley
Pipe made from high-density polyethylene has a unique balance of properties that make it useful in many low-pressure applications. It has demonstrated value in crude oil, gas gathering and distribution, water supply, salt-water disposal, electrical conduit, process lines, sewers, and vent service.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
April 18, 1960

Crude prices are weakening under buyer pressure:

Pattern for last year has been a nibbling market.

Buyers nibble at posted prices—hardly a month now passes without a lower adjustment somewhere (p. 79).*

Latest cuts have touched some very tender spots. Others are studying their own positions after American Petrofina's 19-cent barrel cut in North Texas and Sinclair's 5-cent cut on Rocky Mountain Sweet. Sinclair followed others in 15-cent cut in East Texas and 10-cent cut on Corpus Christi heavy.

Guess of men in the market: Sweeping price reduction will not result at the moment. Present cuts probably will be consolidated. Price nibbles will continue at a faster pace. There'll be no letup in pressure on crude prices.

That's why restraint now by refiners and producers can stabilize the product and crude markets (p. 75).

It's the key to a much improved last half when both higher runs and crude production may be possible. Some guidelines:

...Refiners should keep runs at 7,800,000 bbl. daily in April and 7,900,000 bbl. daily in May.

...Crude production in April should average less than 7,000,000 bbl. daily with only slight increase in May.

▼ ▼ ▼

Don't be surprised to see Naval Petroleum Reserve No. 4 returned to public domain before too long.

Prospects for this are brighter than ever before. Chairman Vinson of the House armed services committee has agreed to schedule hearings on a bill to restore the 23-million-acre reserve to the public.

Trend in seismic work is noted by one executive for an oil major. His company is spending more and more money on reinterpreting old records—some dating back 20 years.

The reasoning: More subsurface information is available now than when the records were first taken. Drilling

---

*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

data is handy now. Earth responses don't change—only the methods. So there may be some interesting clues in seismic work done years ago.

A remote-controlled gravity meter is in the works. Specially adapted for helicopter work, the instrument can be lowered to the ground while the chopper hovers above. Adjustments on the meter can be made from the cockpit.

A name-change for the American Geological Institute. The reorganized AGI, which includes 14 earth science societies, will consider adopting the name—Institute of Geological Sciences. Officers will weigh the matter April 24 in Atlantic City.

▼ ▼ ▼

Cooperation is lagging in API effort to collect data to help in formation evaluation.

At least two sources reported this condition to special formation evaluation committee of Mid-Continent District API.

Big fear: Management of oil firms doesn't realize importance of collected data. Entire industry stands to gain from the program since the data will be available to all for log interpretation.

Strange twist in cost cutting: Some producers are saving by electrifying their leases.

In many areas where no gas is brought up with the oil, power costs are sharply under those of LPG for operating pumps and other production equipment. Also electric utilities are more cooperative now on matter of getting service to remote oil areas.

Operating notes: First quintuple completion may come this week at Sinclair wildcat offshore from St. Mary's Parish on Louisiana coast. Well tested production from five zones, is awaiting storage before being completed (p. 77)...Small bits can make hole in deep, hard formations. Hunt Oil proved it with a 3¾-in. diamond bit in deep section of 20,603-ft. wildcat in Webb County, Texas (p. 78)...New way to calculate optimum efficiency of gas-lift well has been devised by Garrett Oil Tools. It's called Opti-Flow process and key to the method is set of master curves...Pilot-plant automation is rapidly developing into a major research tool—at least 10 refiners are planning to go that route (p. 94).

Invasion of Great Lakes market by Canadian propane will be impossible—unless producers want to give product away.

This is view of Robert E. Thomas, president of Mid-America Pipeline, which plans to complete its LPG line from

Eunice, N. M., to Minneapolis and Madison, Wis., by winter.

Obstacles to a proposed Alberta-Chicago line: Higher tariff, smaller volumes, and an import duty.

▼ ▼ ▼

Amoco will modernize and expand its Texas City plant. It plans to replace present units with 150,000-bbl. crude unit, cat cracker of 47,600-bbl. capacity, and a 14,600-bbl. alkylation unit. Crude-charging capacity of plant will be increased only by 10,000 bbl. daily.

Alaskan crude has western Canada producers worried. Although this crude is not moving to market yet, it is generally expected that some of the first customers will be refineries in Washington State. At present, these plants are first-rate markets for Alberta crude.

Universal oil credit card will be started this year. There's plenty of interest in idea so far but a hesitancy by oil marketers to join up.

Two possibilities now exist:

...Two majors reportedly are ready to go with a plan if four others of like business stature will join.

...Some 30 to 40 small gasoline and oil marketers may join in a universal card to get nationwide coverage. Four have approved the idea and 13 are expected to do so.

OCAW's 1961 bargaining program for the oil industry is taking shape in preliminary meetings over the country.

Suggested goals picked up at sessions so far include:

Substantial wage increases; switch of company-controlled benefit plans into trust funds administered by union and management; all costs of fringe benefits paid by company; an end to contract maintenance; eliminate overtime to bring true work week to 40 hours.

▼ ▼ ▼

The Washington beat:

Congress will start gaining momentum, now that it has finally cleared the civil rights hurdle. Little major legislation is likely, however, because Congressmen want to get through before convention time in July.

Biggest danger lies in attempts to push pet projects in the adjournment rush. And some issues, such as percentage depletion, may be raised to put presidential hopefuls on spot.

Don't underestimate chances for passage of fair-trade law. It has strong backing, especially by drug industry.

Congressional probes of FPC will continue. The issue: Whether FPC members have been influenced.

Market Memo

April 18, 1960

Spring is late and so is summer gasoline demand.

A Gulf Coast refiner last week incongruously sold a T-2 of 98-research octane gasoline on a delivered price basis netting back three-quarters cent under the 11.75-cent posted price for prompt lifting.

It was an Easter bargain sale at a winter discount price. Gulf Coast spot gasoline price is nearer one-half to five-eighths cent off posted for prompt cargoes.

Other Gulf Coast trends: Middle distillates are in the seasonal doldrums, priced spotwise at one-half cent under posted price...In lieu of trading stamps, refiners will sell top-quality diesel oils at one-quarter cent under No. 2 posted price of 8 cents or at 7.75 cents per gallon prompt lifting... No. 6 is in short supply to meet current demand. Price is firm at posted $2.10-2.25 per barrel for Bunker C and $2.45 for low-sulfur fuel. Supply for April-May, however, is gone, and premiums, promises, and payola will not bring out No. 6 in the Gulf Coast for prompt lifting.

East Coast shortage of No. 6 was politically spawned and politically compromised. An irresistible No. 6 demand met an insufficient supply...The Government increased No. 6 imports 12 million barrels for April 1-June 30 period—about half as much as needed. It was an NRA solution—and that dates most of us. Shakespeare's comment would be: "The snake is scotched, not killed."

Mississippi River markets continue firm. Undercover favors on prices to special friends are disappearing, and gasoline prices are firm at one-quarter cent under Gulf low posted prices for river terminals...West Memphis price could go to Gulf Coast lows if current weather permits dawn-to-dark plowing and driving...Middle distillates—in a listless demand period—are priced at Gulf Coast lows but subject to discounts for midriver terminals.

Strengthening trend is slowing down for Great Lakes pipeline gasoline. Spot sales of regular bring 11 cents on low side. But scrap may develop after one supplier reportedly is selling below 11 cents to favored customers.

Even Chicago markets are firm. Gasoline is tight at the posted 11.625 cents with no more than one-quarter cent off to big buyers, and that's historically a firm Chicago market... Middle distillates are priced at one-quarter to three-eights cent off posted, and this position is supported by low inventories and ample storage to hold.

Good Wells Make Good News

A Report on Recent Treatments Using Abrasijet

April 18, 1960

Abrasijet* — a Dowell-developed abrasive jetting service — uses high velocity streams of sand-laden fluid to perforate casing or clean hole walls. Here are four recent examples of the kind of results many operators have experienced.

- **Harrison County, East Texas** (New Oil Well) Pay zone was the highly soluble Glen Rose. Since the water table was only six feet below the producing interval, operator was afraid to use conventional perforating. Abrasijet was used to perforate from 4492 to 4493 feet with a vertical cut and from 4494 to 4495 feet with a vertical cut. 5000 gallons of 5 per cent acid and 5000 pounds of sand were jetted. Following Abrasijet, well tested 192 bopd without further treatment. This is considerably better than the 125 bopd average test of wells in the area that have been perforated with explosives and then acidized.

- **Lea County, New Mexico** (New Oil Well) This well was to be completed in the Grayburg and San Andres between 4501 and 4734 feet. Abrasijet was used to perforate because fracturing pressures of 6000 to 8500 psi had been required after conventional perforating. 55 levels were jetted allowing about four minutes at each level. Total jetting time was 216 minutes. Well was successfully fractured at only 4900 psi. Production is top allowable.

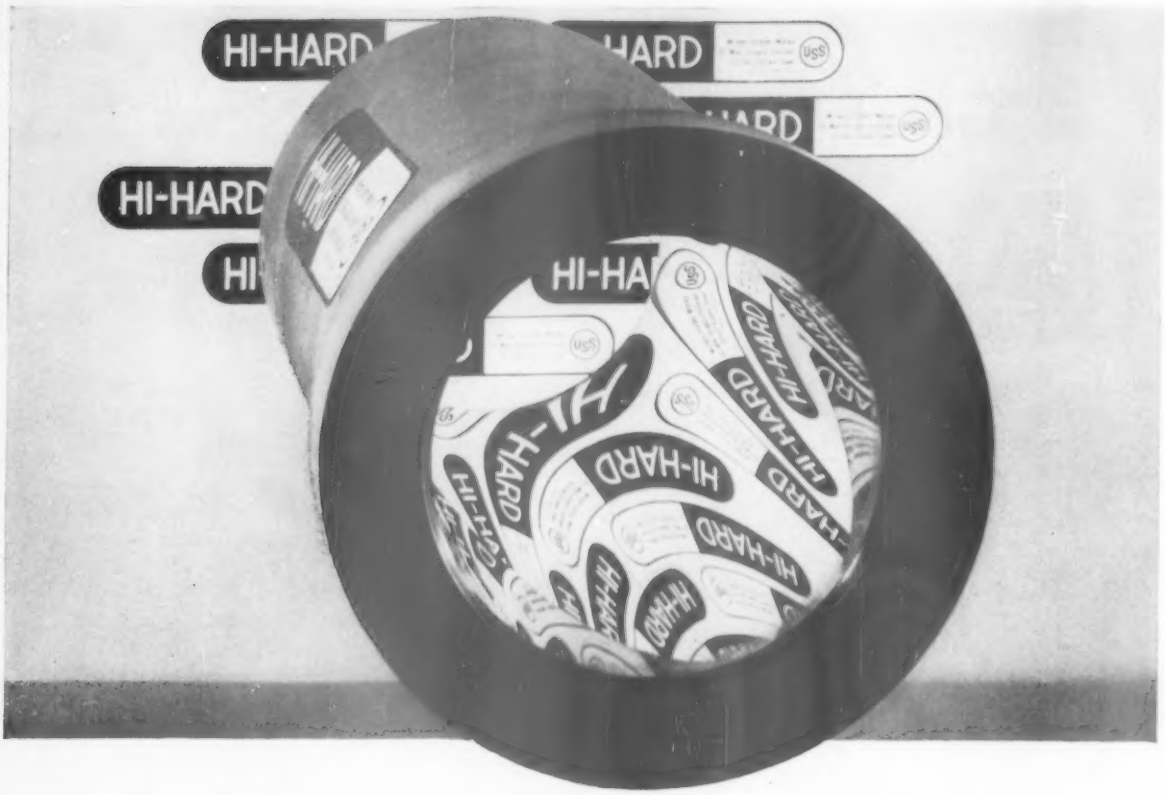
- **Kingman County, Kansas** (New Oil Well) This well was to be completed in the Mississippi lime at 4428 and 4434 feet. Other nearby wells had very high gas/oil ratios and were completed as gas wells. The operator wanted to get a low gas/oil ratio so this well could be completed for oil. Abrasijet was used to perforate at 4428 and 4434 feet. No further treatment was necessary. On test, the well swabbed 22 boph. Gas lift equipment was installed and a good well with a low gas/oil ratio resulted.

- **Montgomery County, Southeast Texas** (Old Oil Well) This well had depleted a lower zone of the Conroe sand, so the operator set a five-inch liner in the seven-inch casing before re-completing. Abrasijet was selected to perforate because of the heavy steel and cement sheath. Two perforations were jetted at each foot from 5019 to 5023 feet. 7500 gallons of salt water and 7400 pounds sand were used for jetting. Well came in flowing 54.5 bopd through a 10/64-inch choke. Gas/oil ratio was 507/1.

Many times, Abrasijet is the most economical way to perforate if a well is to be stimulated by fracturing or acidizing. Often, it has proved to be the only way to complete a problem well successfully. For service or detailed information, dial Dowell. Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Venezuela and Argentina. Dowell, Tulsa 1, Oklahoma.

*Dowell Service Mark

Services for the oil industry DOWELL
DIVISION OF THE DOW CHEMICAL COMPANY



Here's "Oilwell's" new HI-HARD Liner that can be EXCHANGED and RE-BUILT!

Note the extra depth and complete uniformity of its hardened inner case, as shown in the rough-cut section at the left. Here's proof aplenty that premium quality hardened steel HI-HARD Liners will withstand many hours of extra wear before re-working becomes necessary.

Honing and polishing brings this HI-HARD case to the mirror finish, shown above, which prolongs the life of piston rubbers and greatly extends the periods between rubber changes.

Then there's another important feature! After intensive metallurgical research, we selected a special forging steel with properties exactly right for successive heat treatments. Consequently HI-HARD Liners can be re-built many times without affecting their finished quality.

Operators who swear by the outstanding performance of "Oilwell's" DI-HARD Liners may not be interested in this particular feature. But if you want liners that can be reconditioned, we know you'll go for HI-HARD's because they're equally outstanding in the re-workable class.

Any "Oilwell" Representative will be glad to tell you all about them. Ask him today!

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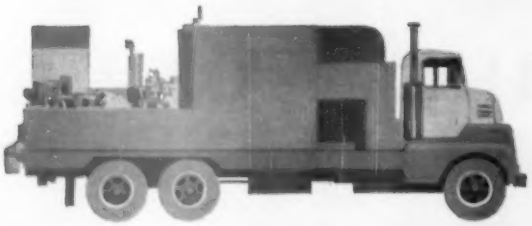
LIQUID HUMBLEFRAC CONCENTRATE



FOR BETTER FRAC JOBS

HUMBLEFRAC CONCENTRATE is a liquid-type fluid loss additive that can be accurately measured into the fracturing oil to obtain the optimum blend. With HUMBLEFRAC CONCENTRATE more of the fluid remains in the fracture system, to extend the fracture and allow propping sand to be placed.* It increases the sand-carrying capacity of the fluid. HUMBLEFRAC CONCENTRATE contains no solids to harm conductivity of the fracture, or to cause permeability damage. Return of frac fluids is quick and complete. HUMBLEFRAC CONCENTRATE is available in 14 and 55 gallon drums and in bulk. For complete technical information, call your Humble salesman or contact Humble Oil & Refining Co., Houston, Texas.

HUMBLE

HUMBLE OIL & REFINING COMPANY

* HUMBLEFRAC CONCENTRATE has been tested and proved in actual reservoir rock cores and in the formation, *where it counts*, not in artificial filter paper tests.

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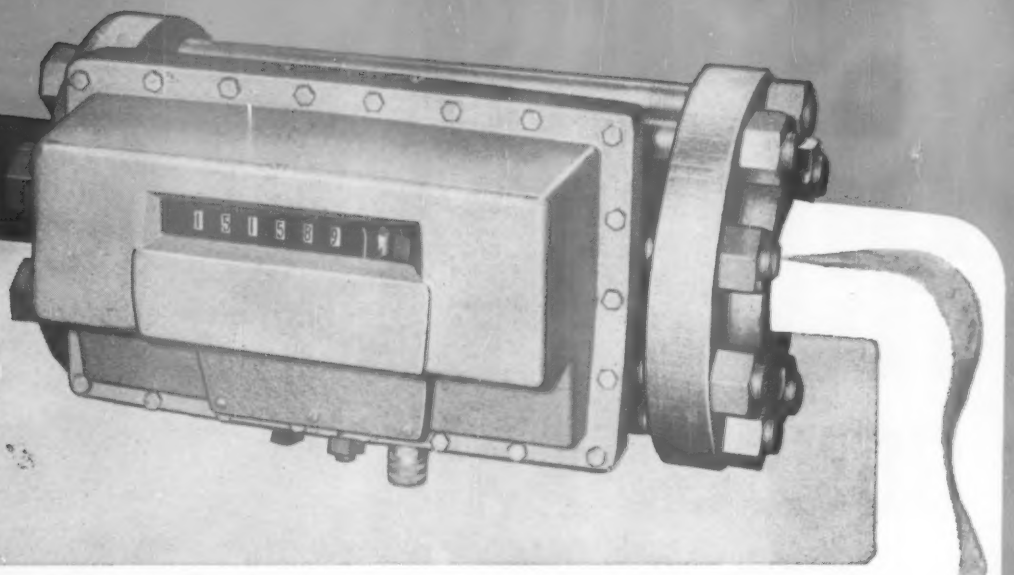

AVAILABLE NOW

The BS&B-GE Gyro-Integrating True Mass Flowmeter For Natural Gas*

Gives Accurate Gas Flow Measurement Under Wide Variation of Flow Rates, Pressures, Temperatures and Densities

You've read about the True Mass Flowmeter for natural gas. Now, you can put this accurate measuring device to work for you.

True Mass measurement eliminates the problems associated with varying gas densities, super-compressibilities and other physical properties. Measures directly and precisely the gas flow rate in pounds. Readily adapted to automation.

The BS&B Mass Flowmeter makes possible new economies at nearly every level of natural gas measurement. You get large savings not only from reduced calculating time but also from increased accuracy in gas accounting.

Gyro-integration in the meter eliminates chart handling and chart-integration by planimeter. The small, light, self-contained meter is ready for installation — no meter run is required. It's simple to operate and has long service life.

Get highest accuracy from this newest development in mass flow measurement. To prove this meter out for the natural gas industry, BS&B constructed a special prover facility which is believed to be the first positive prover for gases. For your specific application, write . . .

EFFICIENCY
OVER 60 YEARS
BS&B
RELIABILITY
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

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Mass Flowmeter Sales, Dept. 3-A4, P.O. Box 1714, Oklahoma City, Oklahoma

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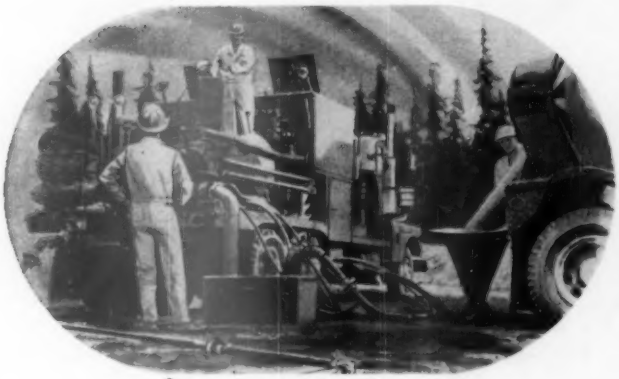
TWO NEW HALLIBURTON FLOAT VALVES

DESIGNED for CEMENTING ECONOMY



SAVE ON INITIAL COST

SAVE TIME IN RUNNING CASING

SAVE EXCESSIVE DERRICK STRAIN

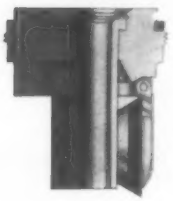
SAVE ON DRILL-OUT TIME

INSERT FLOAT VALVE

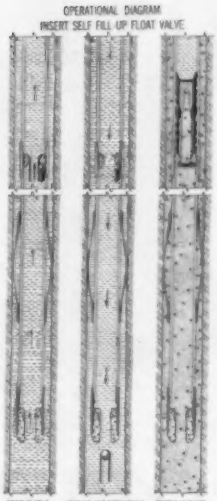
This new Halliburton tool is low in cost, simple in design, and efficient in operation. Installed by a short thread inside the casing coupling and sealed between the casing ends, no length is added to the string. Eliminates two threaded connections for each valve used in the string.

Designed for use in wells where a medium range of differential pressures exist, the assembly consists of a readily-drillable cast aluminum body, flapper valve and spring and two rubber sealing rings. The stout spring helps hold the valve closed during floating-in and after cementing is completed. This tool is excellent for use with a "DV" Multiple Stage Cementer.

INSERT SELF FILL-UP FLOAT VALVE



A combination of the new Insert Float Valve described above and a simple self fill-up assembly incorporating a plastic orifice tube, the Insert Self Fill-Up Valve was designed for use in filling casing in areas where field conditions sometimes interferred with other fill-up devices. See illustration. A pre-selected, special size orifice tube holds the valve open allowing the casing to fill going in the hole. When the casing is within a few joints off bottom, a weighted plastic ball (furnished) is dropped and seats on the valve. After reaching casing point, pressure is increased to break the orifice out of its seat. The plastic flow tube and ball drop through the guide nose to the bottom. The valve then closes and acts to help prevent reverse circulation during and after the cementing operation.



ASK your local Halliburton Representative about these new valves. He will help you select the proper unit to match your well's requirements.

HALLIBURTON

CEMENTING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

"TOOLS AND EQUIPMENT TO MATCH THE JOB"

NOW MID-CONTINENT SLUSH PUMPS

EXPANDING
the Mid-Continent Line of Drilling Machinery

Since 1938, Mid-Continent Supply Co. has pioneered and field-proved the Emsco Pump throughout the oil fields of the world. Mid-Continent now proudly places its familiar world and derrick emblem on this series of pumps which includes models from 125 to 1000 horsepower capacity. These pumps and parts are 100% interchangeable with the Emsco line. And, Mid-Continent backs these pumps with fast, dependable field service from strategically-located parts and service centers. Call your local Mid-Continent representative today for assistance in selecting a Mid-Continent-Emsco Pump or parts for your drilling requirements.

SP1-0

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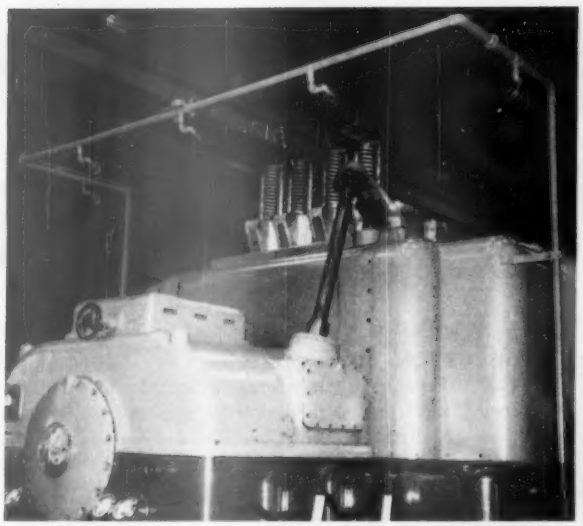
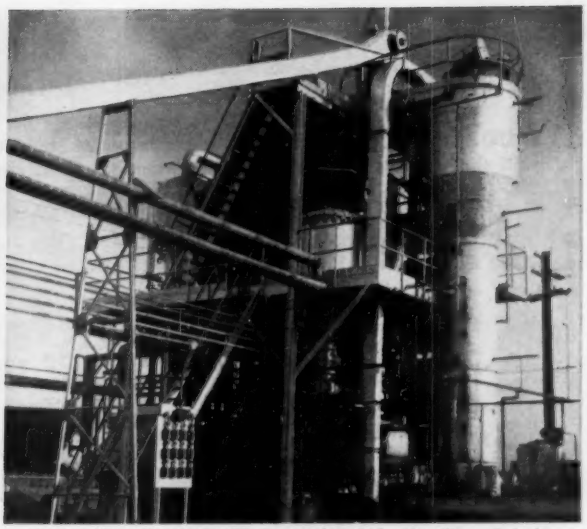
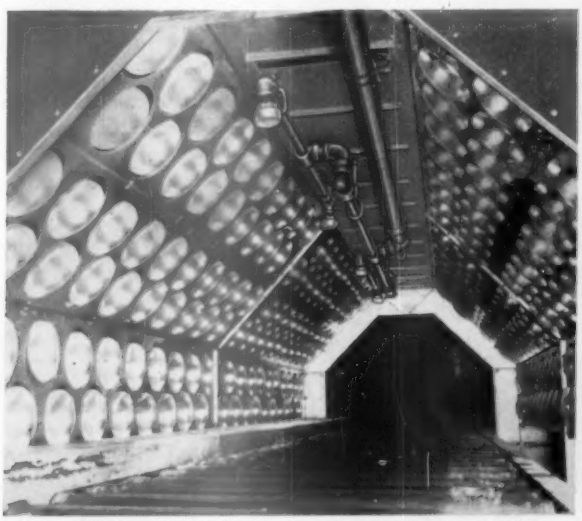


At Pennsylvania Power and Light Company, Sunbury, Pa., this steam generator is protected by an automatic Grinnell Protecto-Spray system in the event of outside fires and by a Dry Chemical system inside the casing.



At Canadian Vegetable Oil Processing Ltd., Hamilton, Ontario, Grinnell ProtectoSpray safeguards upper structure of this hexane solvent extraction unit, while a ProtectoFoam system guards the lower section.



At the RCAF supply depot at Namao, Alberta, this infrared drying oven is protected by a Dry Chemical system engineered by Grinnell to protect against possible fire resulting from ignition of flammable vapor mixtures.

At Dresser Industries, Inc., Dallas, Texas, hot metal temporarily ignites resulting vapors as metal is being submerged. If fire should get out of control, a Grinnell-installed Carbon Dioxide system is on guard to extinguish it quickly.

You can rely on Grinnell for the right protection against destruction by fire!

Grinnell has had 90 years experience in devising fire protection systems for all kinds of fire hazards — systems which can be relied on to protect the continuity of your business and to safeguard your dollar investment. Grinnell offers you quality-controlled manufacturing, layouts by experienced engineers, and installations by skilled crews. Let Grinnell engineers help you select the right system.

16 mm. Sound-Color Film—Get up to date on fire with Grinnell's 35-minute film — "Fire Protection Through Research." Both typical and unusual fire hazards are described and demonstrated. To borrow this film, without charge, write — Grinnell Company, Providence 1, Rhode Island.

GRINNELL

FIRE PROTECTION SYSTEMS SINCE 1870

You save drilling dollars with

THE

MUD PROBLEM: Maintain a stable bay-water mud to drill through hydratable shales and formations containing high pressure gas and salt water.

WELL DATA

Location: Timbalier Bay Field, Lafourche Parish, Louisiana
Total Depth: 15,376′

MUD ADDITIVE PROGRAM

0′ to total depth	Q-BROXIN*, BAROID**, bay water, caustic soda, gypsum.
12,876′	Mud density increased to 12.3 ppg; Q-BROXIN treatment increased; Baroid Mud Centrifuge installed.
13,276′	FINE MICATEX**, and other lost-circulation materials added, maintained to total depth.
14,302′	Diesel oil added, maintained at 6% to 10% by volume to total depth.
14,510′	TRIMULSO** (0.5 lb/bbl) and E P MUD-LUBE†, (4.0 lb/bbl) added, maintained to total depth.

TYPICAL MUD PROPERTIES

Depth, feet	12,950	13,464	14,064	14,510	15,003	15,376
Weight, ppg	12.1	12.5	13.3	14.3	15.6	16.6
Ave. sp gr, solids	2.8	3.0	3.0	3.2	3.8	3.7
Viscosity, sec. API	55	48	54	66	58	65
Stormer Gel, 10 min	25	25	20	10	7	15
Filtrate, ml, API	5.5	4.9	3.9	1.6	1.8	1.2
pH	10.9	10.4	11.1	10.4	10.2	10.6
Chloride, ppm (1000's)	19	23	21	23	22	23
Oil, %	0	0	0	6	9	7

CASING PROGRAM

Size Inches O.D.	*Depth Set Feet*
13⅜	6,464
9⅝	14,871

DISCUSSION: Major difficulties were anticipated below 14,000′ because of gas-bearing hydratable shales. Side wall coring, electric and induction logging and similar operations required an exceptional mud program. Salty bay water was used for making-up the liquid phase of the mud.

SOLUTION: Q-BROXIN mud was chosen as the basic mud additive from surface to total depth. The treated mud had a high degree of tolerance for solids, an inhibitive effect on hydratable shales and was not greatly affected by contaminants. BAROID was added to maintain weight, and FINE MICATEX was used to maintain good hole condition below 14,500′.

Total mud cost was about one-half the cost of previous wells of similar depths. 14,871′ of 9⅝″ casing was successfully set and cemented, the deepest of this size in this field. Side wall cores and good logs were obtained without difficulty.

**Registered Trademark, Baroid Division National Lead Company
†Trademark, Baroid Division National Lead Company
*Registered Trademark of Puget Sound Pulp and Timber Company

a Baroid Mud Program

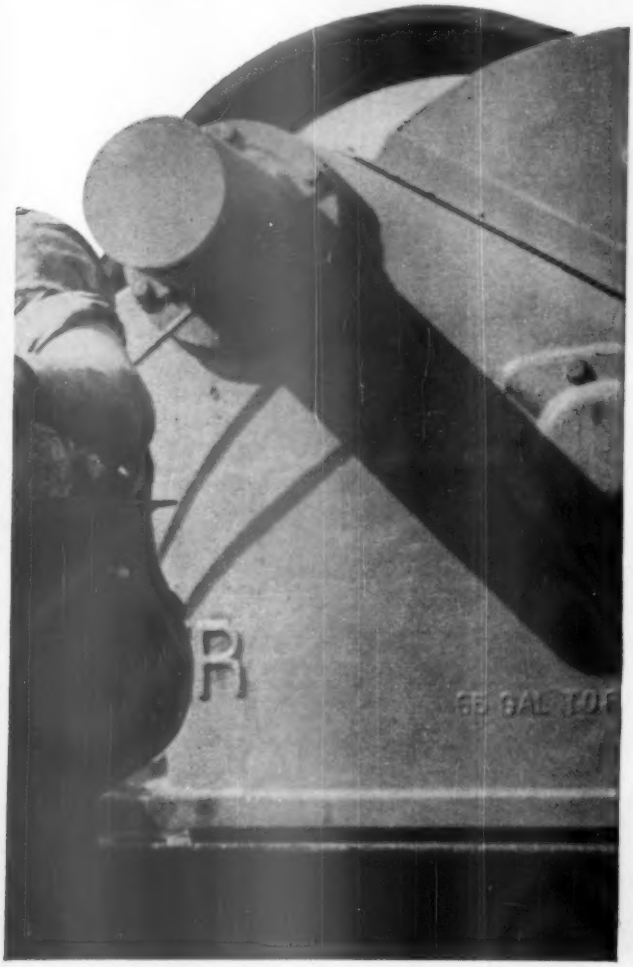
MUD PROBLEM

... and its solution

Total mud costs were cut in half and tight-hole problems were solved in this typical case history of a Baroid mud program. Through experienced engineering skill, a combination of Baroid mud additives were matched against a combination of down-hole conditions with successful results.

Gas pressure, salt contamination and tight-hole conditions were expected at depths below 14,000'. Side wall coring and electrical logging were desired. Using a bay-water — Q-BROXIN mud, frequent pilot testing, and special-purpose Baroid additives permitted successful drilling of the well and setting 9⅝" casing to a record depth in this field.

This demonstration is repeated daily in every major oil area. Baroid's improved concept of mud marketing is winning approval. By integrating material production, engineering research and distribution into a single chain, administered with utmost integrity, Baroid solves your problems and *saves your drilling dollars.*



RESISTS ANHYDRITE CONTAMINATION
OVERCOMES EFFECTS OF SALT WATER
KEEPS MUD STABLE AT HIGH TEMPERATURE
KEEPS MUD DEFLOCCULATED

BAROID

BAROID DIVISION NATIONAL LEAD COMPANY

MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

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Through the outstanding service of the supply industry . . .

round-the-clock, round-the-world

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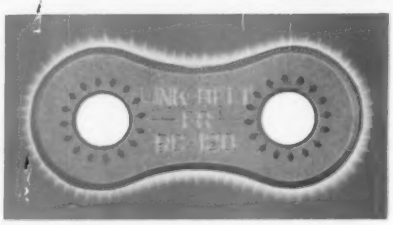
For many years, Link-Belt has worked closely with oil field supply stores. We know there's no faster, more dependable way of getting our products distributed . . . when and where they're needed.

Roller chain is just one of many Link-Belt products handled by your favorite supply store. Composite Catalog 2980 has complete information on *all* Link-Belt oil field equipment: chains, sprockets, couplings, speed reducers, shale shakers and bearings. For your copy, contact your leading supply store. 15,644



GREATER DYNAMIC STRENGTH! Link-Belt roller chain has exceptional resistance to fatigue—achieved through Link-Belt's patented FR (Fatigue Resistant) process. Sidebars, the components most vulnerable to severe shocks of continuous drilling, have been fortified by compressing the metal around pitch holes. The result is a substantial increase in dynamic strength.

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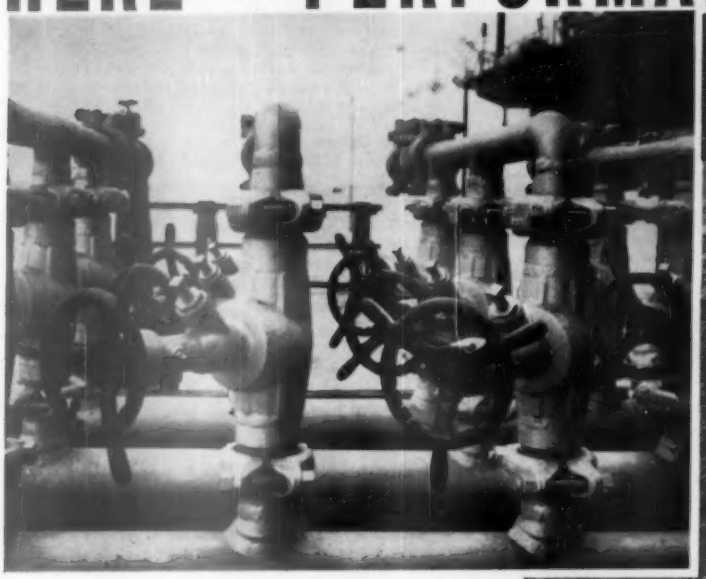
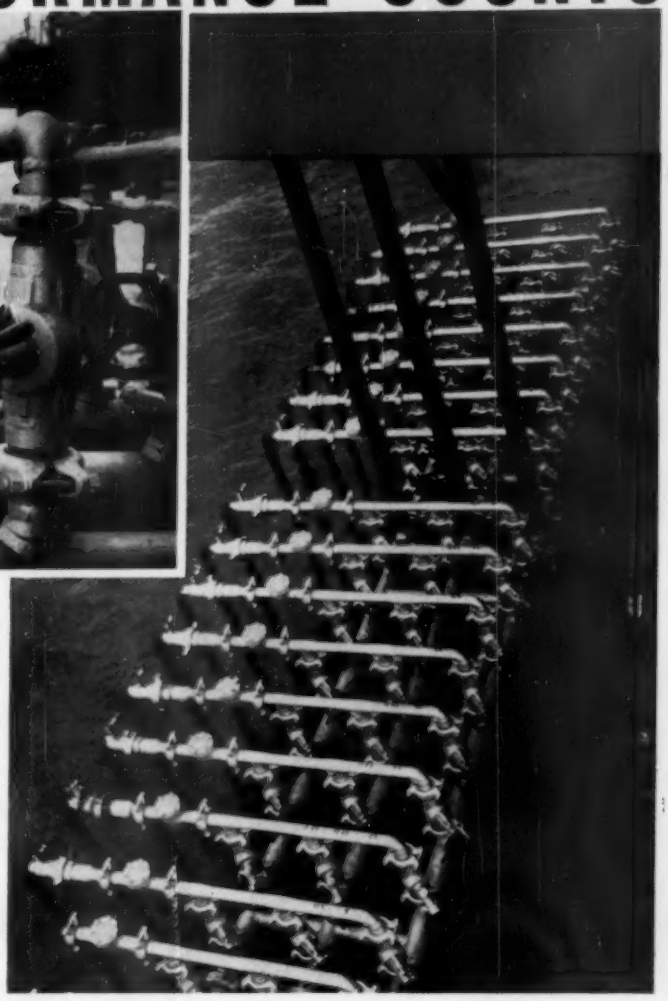
ROLLER CHAINS AND SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 26, Odessa, Tex., New Orleans 16, Shreveport, La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields.

HERE — PERFORMANCE COUNTS





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Write for Catalog 58-A covering Production Valves, 58-B covering ASA Class Valves.

ORBIT VALVES ®

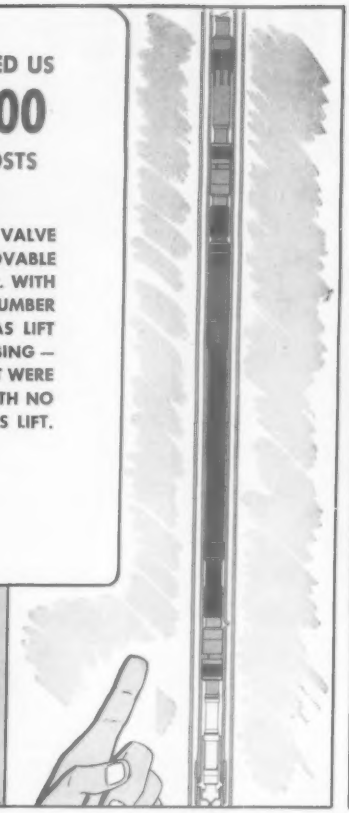
1.

THIS OTIS TOOL SAVED US

$350,000.00

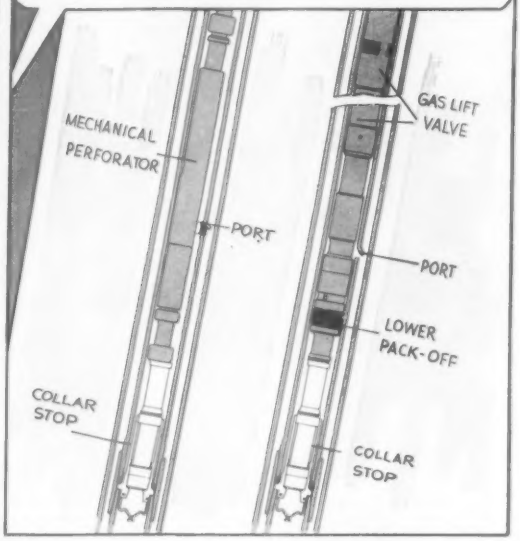
IN WORKOVER COSTS LAST YEAR.

IT'S THEIR TYPE C GAS LIFT VALVE RUN WITH A TYPE G REMOVABLE TUBING PACK-OFF ANCHOR. WITH IT OTIS CONVERTED A NUMBER OF OUR OLD WELLS TO GAS LIFT WITHOUT PULLING THE TUBING — AND THEY WERE WELLS THAT WERE ORIGINALLY COMPLETED WITH NO PROVISIONS MADE FOR GAS LIFT.



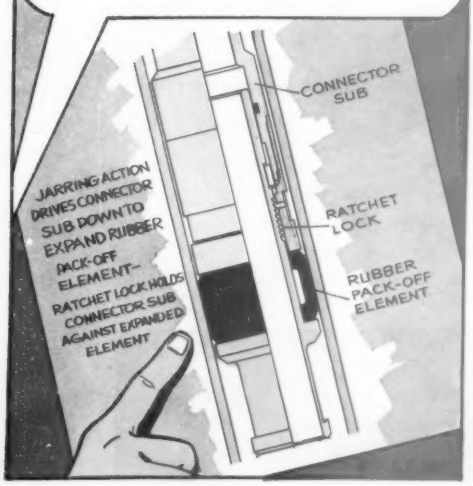
2.

The technique Otis uses in this type of recompletion is simple and fast. First, their gas lift specialists determine the number of valves required and the proper spacing. Then they cut a port in the tubing with a wire line mechanical perforator and pack-off their gas lift valve opposite the perforation. A full opening tubing stop locks the tool in the tubing. To give you some idea of the capacity of this type of installation, WE'RE MAKING 1,200 BARRELS OF FLUID PER DAY THROUGH 2" TUBING FROM ONE OF THESE WELLS.

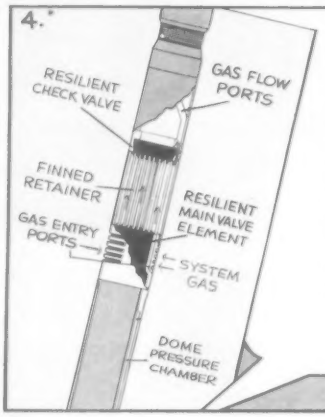


3.

And this Otis pack-off gas lift completion technique is one of the most foolproof we've ever had. For example, we know each valve straddles the port in the tubing because the lower pack-off anchor is landed on the same Otis collar stop used to locate the perforator. Also each check valve and pack-off can be tested as it's run by pressuring up on the tubing. And because the pack-off elements are set against the tubing wall mechanically, we know they'll stay expanded. Here's how the pack-off elements work.


CONNECTOR SUB
JARRING ACTION DRIVES CONNECTOR SUB DOWN TO EXPAND RUBBER PACK-OFF ELEMENT—
RATCHET LOCK HOLDS CONNECTOR SUB AGAINST EXPANDED ELEMENT
RATCHET LOCK
RUBBER PACK-OFF ELEMENT

4.



As for Otis Gas Lift Valves — this diagram will help explain why THEY REALLY LIFT THE FLUID. They have no spread — consequently you get maximum efficiency from your system gas. The valves have no moving metal parts, no bellows to fatigue, no seats to cut out — and they have extra flow ports to pass a maximum amount of gas at a minimum pressure. With Otis valves in your well you can produce by either continuous or intermittent lift — without the expense of changing valves.

Otis tells us they run a lot of these pack-off gas lift valves to straddle old style "piggy back" valves and eccentric side pocket mandrels when they become defective. They also install them in dual- and triple-completions. BEFORE YOU PULL TUBING to put any of your wells on artificial lift, I suggest you GET IN TOUCH WITH OTIS and talk to their gas lift specialists. We did, and it gave us some of the most economical and efficient gas lift installations we've ever had. It's no wonder Otis has the reputation of being

"First in Gas Lift Control"

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Branches Throughout the Oil Country

and each heat of steel used in making Liberty Sucker Rods is normalized at a "tailored" temperature.

The normalizing temperature vitally affects the physical properties of sucker rods. It is so important that, at Liberty, each heat of steel is carefully tested and analyzed so that the one exact normalizing temperature can be predetermined to assure the maximum desirable physical properties.

Unless this "tailored" normalizing temperature is determined exactly, variation in the physical properties of sucker rods of the same type is possible. This, in turn, could mean that rods in the same production string would have different performance characteristics, and, as every producer knows, a rod string is only as strong as its weakest rod.

That is why Liberty spares no expense or effort to assure that every Liberty Sucker Rod of the same type and size performs exactly as specified. For at Liberty, the goal is not to produce the most sucker rods in the least time, but to produce the finest sucker rods — regardless of time!

FOR EXCELLENT PRODUCTS AND SERVICE
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Allis-Chalmers' big side boom tractors have a *reputation* among pipeliners for walking right through gooey swamps that are out of bounds for other pipe layers. Long, wide tracks stay on top of mud. But it's more than just square inch of ground contact. Allis-Chalmers tractors have exactly the right combination of weight, center of gravity and clearance to stay afloat where other equipment bogs down.

They're agile climbers, too, with a combination of excellent balance and big power. From the 99-hp HD-11 to the 225-hp torque converter HD-21, Allis-Chalmers tractor engines have the deep-down lugability for steep hillside work.

Durability and safety are built in, too, with waterproof, internal-expanding side boom brakes . . . dropproof hydraulic counterweights . . . shock-absorbing,

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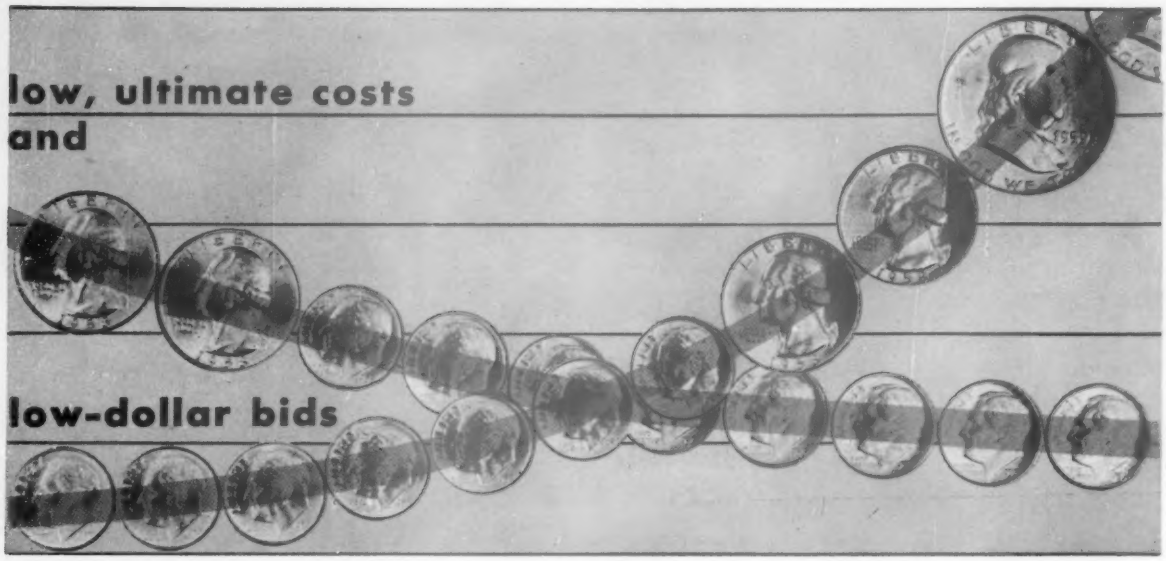
OR MOUNTAIN

all-steel tractor main frame . . . durable, double-reduction final drives . . . toughest track ever made. Certified permanent lubrication of tapered roller bearing truck wheels, idlers and support rollers eliminates greasing — saves time and cost.

Your Allis-Chalmers dealer will give you moneysaving proof why the 127,000-lb capacity HD-21, the 78,000-lb capacity HD-16, and the 40,000-lb capacity HD-11 are your best tractor buys — come swamps, mountains or biggest inch pipe. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

power for a growing world



are not the same

The historic struggle between long-range economy and "low-dollar" first-cost is brought into extremely sharp focus in the competitive bidding for heat transfer equipment sales in the process industry . . . especially where *continuous flow* processes are involved.

Recognition of *all* factors contributing to the economy of such continuous, uninterrupted operations has become the cornerstone of Western's appraisals and solutions. It is further reflected throughout the design, mechanical, thermal and rating phases of the engineering of each Western Heat Exchanger.

Western engineers understand this "fact of life": we must, to the best of our ability, anticipate the *continuing expense* of operation and maintenance of heat exchangers, so that such ultimate costs are kept at a minimum, and our exchangers *operate at a profit* for our customer. Otherwise, it is false economy indeed, regardless of the "initial cost."

Western Heat Exchangers are quoted for *long-range economy*, not short-sighted "low-dollars" . . . and a visit with a Western engineer will show you how and why.

WESTERN'S STAKE IN YOUR FUTURE

In today's "business arena" it is increasingly important for process engineers to take the *full* look at *true economy* in the production of chemical and petro-chemical products. Pointing to the need for such understanding is the next of Western's "professional-advancement" messages, shown at right, currently seen in leading petroleum and chemical trade journals . . . and available in more complete detail in pamphlet form, upon your request.

One of a series appearing in OIL & GAS JOURNAL, CHEMICAL ENGINEERING, PETROLEUM REFINER, REFINING ENGINEER, CHEMICAL ENGINEERING PROGRESS.

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"LOW FIRST-COST vs. LOW ULTIMATE COST" controversy demands understanding of economics involved

When is a "low bid" really low? This perplexing question consistently faces the engineer charged with the responsibility of ordering capital process equipment with a wary eye towards the profitability of such equipment in his company's long-range economy, yet, beset with the necessity for tightly-budgeted current operations.

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Envisage, Sirs, a "pneumatic control loop". Here, for example, we offer instruments to measure not merely flow, but also temperature, pressure, level, density, viscosity, and consistency.

Notice how Fischer & Porter devices are available to convert the diverse outputs of these many measuring instruments to clear and accurate pneumatic signals to be sent whistling through pipes to the heart of the loop . . . the control center.

Now note the multiplicity of Fischer & Porter instruments diligently performing their assigned tasks at the control panel. There are large and small case instruments with controllers tucked inside. There are miniature instruments with controllers riding piggy-back.

Surely, it beggars description. Yet this represents but a modest sketch of our line. For we are an INSTRUMENT COMPANY. And we pride ourselves on the availability of an instrument to fit every kink in the knottiest control loop.

Need we say more? Have we convinced you? Perhaps not!

But may we recommend that you spend a few precious moments with our Catalog Number Two? It is a brief presentation of our standardized instruments, and has won the hearts of instrument users everywhere. May we send you a copy for your own use?

They Are All Buying F&P Temperature And Pressure Transmitters With The Fiberglass Case!

ASK THEM WHY AND THEY WILL TELL YOU: They give the best results under all imaginable circumstances of use. There is a large clear indicating scale at the very point of transmission. Readily withstanding the onslaught of CORROSIVE acids, alkalis, salts, solvents, &c., they are proof against degradation by DUST and MOISTURE as well. So they have proved themselves in actual operation and are pronounced by those who have used them THE FINEST OF THEIR KIND!

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COME ONE COME ALL

TWICE THE TORQUE
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NEW BELLOWS METER
NEW BELLOWS METER

This astounding new addition to the Fischer & Porter line has amazed the populace. Wherever it has been exhibited it has occasioned the selfsame response. Strong men cry! Ladies faint!

Do you ask why? Find a comfortable seat and observe the reasons:

Does it have twice the torque of old fashioned styles? YES! YES!

Does it eliminate mercury, seal pots, purges, &c.? YES!

Does it require leveling? NO!

Does it have full pressure rating overrange protection? YES!

Does it control? Transmit? Integrate? YES! YES! YES!

Does it exceed all others of its style in workmanship, precision, and all-around worthiness?

Modesty, gentlemen, prohibits a response But your interest will be rewarded with satisfaction. Our work is our bond!

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No more overdamping! No more underdamping!

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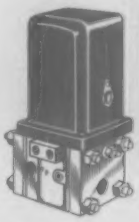
This popular differential pressure transmitter undeniably supports its claim as being the best in the world! Ever since it was first presented to the public its success has been little short of remarkable. WHY? It must be that its superiority over all others is substantiated by the FACTS OF ACTUAL USE!



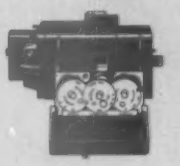
AMAZING ADVANTAGES
found in no like instrument

- Adjustable damping in the differential sensing system, Gentlemen, which is where it should be. We warrant there to be no other method that insures you the *fastest response*, eliminates *extraneous forces*, and wipes out *signal noise!*
- Process fluid CANNOT CONTACT any critical part whatsoever. A perfectly sealed measuring chamber filled with the celebrated silicone oil PROTECTS ALL WORKING PARTS.
- Its operation requires NO MERCURY! And it is a rugged, sturdy, all-metal structure that will serve you well in every respect through the years.

what will they think of next?
they will think of the

53P CONTROLLER!

that is what
they will think of next



- A true TRIPLE-THREAT controller! The same unit is used in large case instruments, plugged into miniatures, and for field mounting. TRUE standardization!
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- Let this fine instrument speak for itself. But be advised that it SPEAKS IN A WHISPER, for it has a *non-bleed type* amplifying relay.
- It has the simplicity of motion balance design, which combined with the amazing REGENERATIVE FEEDBACK . . . provides the performance of force balance design.

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- 24 hours stable record
- Single ruggedized proven reverse acting action
- Non-interacting calibration adjustments from the front
- Positive timing motor

MAKE A COMPARISON and you will soon recognize to your own satisfaction why even the most fastidious find in the Fischer & Porter product all that can be desired of a miniature instrument.

____"Standardized Process Instruments"
____Temperature & Pressure Instruments
____Bellows Flowmeter
____Miniature Instruments
____53P Pneumatic Controller
____DP Transmitter

NAME: TITLE:

COMPANY:

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These MANUFACTURING AFFILIATES carry Fischer & Porter engineering designs to the far corners of the earth: FISCHER & PORTER (CANADA) LTD., DOWNSVIEW, ONTARIO. • FISCHER & PORTER LTD., WORKINGTON, CUMBERLAND, ENGLAND • FISCHER & PORTER G.m.b.H., GROSSELLERSHAUSEN, BEI GOTTINGEN, GERMANY • FISCHER & PORTER N.V., KOMEETWEG 11, THE HAGUE, NETHERLANDS • FISCHER & PORTER Pty. LTD., 184 HANNA ST., SOUTH MELBOURNE, VICTORIA, AUSTRALIA.

Typical engine-generator set in use by Dixilyn Drilling Corp. on the "Julie Ann." Superior 8-cylinder diesel drives 500 KW generator and fluid coupling to provide both electrical and mechanical power.

new rig power with four-way flexibility ...White's DRILLECTRIC*

COMPLETE POWER RANGE—263 POSSIBLE COMBINATIONS

Drillectric—all-electric or electro-mechanical systems—now offers the broadest possible range of power units for oil well drilling. An extensive line of Superior engines, completely packaged with generators, motors and other components permits up to 263 combinations.

CHOICE OF DIESEL, DUAL-FUEL OR GAS

Choose from 5 diesel and dual-fuel engines, or 2 gas engines. Engine-generators can be specified in groups of 2 to 4 in "building block" fashion, so you can customize your rig. You can interchange groups of gas or diesel engines or swing from gas to diesel power in dual-fuel models.

ALL-ELECTRIC OR ELECTRO-MECHANICAL SYSTEMS

All-electric systems use electric motors for all power driven equipment. Electro-mechanical systems use electric motors for draw-works and rotary table and compounded mechanical power between engines and mud pumps. The number of electrical components is reduced to a minimum commensurate with practicability and safety.

FREEDOM OF POWER LOCATION ON RIG

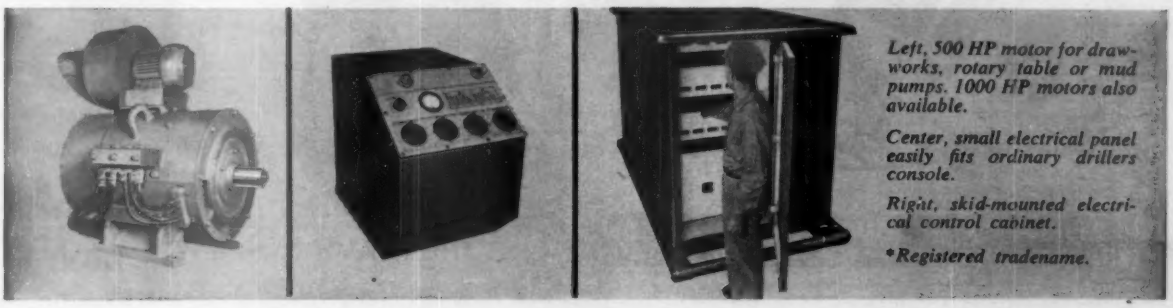
In either system, group composed of engines, generators, motors or chain compound, and pumps can be located without regard to draw-works power. For a barge rig, this package can be housed in an engine room. For land rigs, it is not necessary to construct an expensive elevated substructure, nor to place the power group close to the derrick floor. This complete freedom of location promotes better arrangement of machinery and lowers cost.

Get new *Drillectric* Bulletin 123 from leading rig manufacturers, White oil field representatives, or through White Diesel Engine Division.

Superior ENGINES · ATLAS Imperial DIESEL ENGINES · White DIESEL

White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY
Plant and General Offices: Springfield, Ohio



Left, 500 HP motor for draw-works, rotary table or mud pumps. 1000 HP motors also available.

Center, small electrical panel easily fits ordinary drillers console.

Right, skid-mounted electrical control cabinet.

**Registered tradename.*

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McKISSICK

THE BEST SNATCH BLOCK FOR YOUR PURPOSE

FROM McKISSICK'S FAMILY OF CHAMPIONS

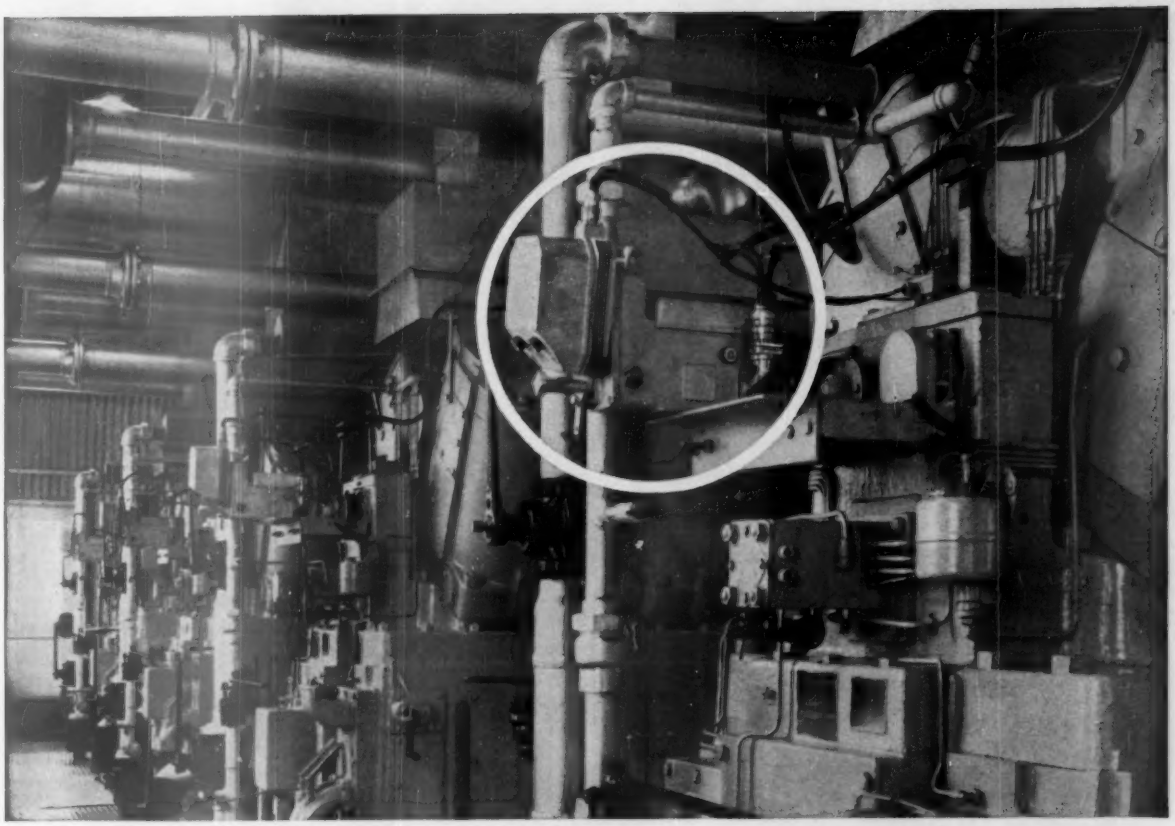
THE SUPER

- 4 to 40 Tons working capacities
- 4½ to 18″ Diameter Steel Sheaves
- Swivel Hook or Swivel Shackle
- Drop forged, Heat treated, Swivel Hooks, Yokes & Shackles.
- Be Specific, get McKissick

THE HEAVY

THE LIGHT

McKISSICK PRODUCTS CORPORATION
Box 2496 Tulsa, Oklahoma



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designed specifically for natural gas and petroleum industries

A MATCHED IGNITION SYSTEM

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5. Positive spark timing
6. High voltage output
7. Matched ignition system
8. Single or dual ignition
9. Flameproof
10. Low maintenance costs
11. For engines of 6 through 16 cylinders

At the installation shown here, DLC Ignition unfalteringly performs its function in aiding with the preparation of natural gas for consumer use.

Bendix* DLC Ignition is the result of the most modern engineering design, and incorporates the latest developments in ignition materials. That's why it meets the most exacting requirements of modern high-compression engines used by the natural gas and petroleum industries.

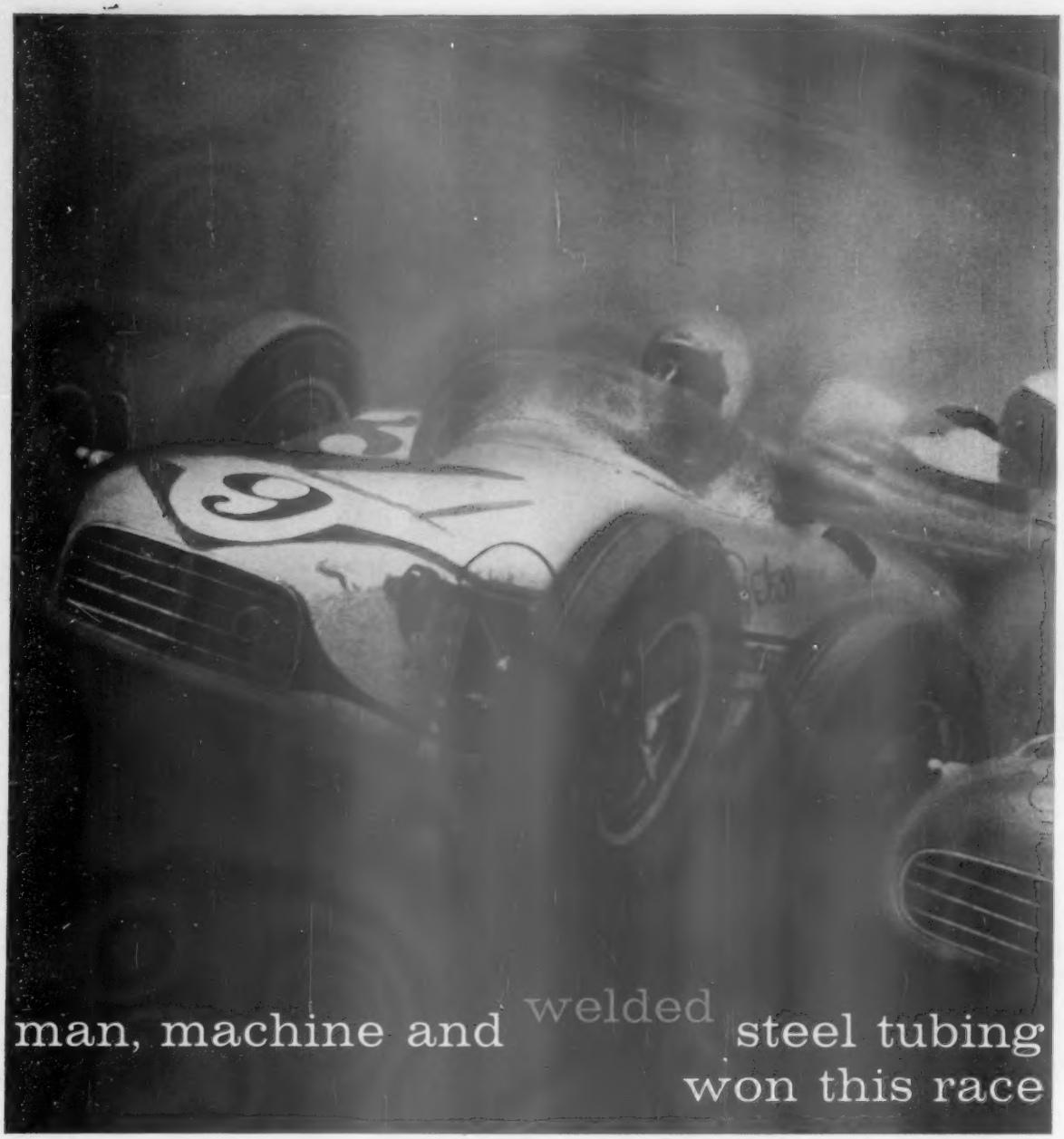
Because DLC Magneto and Hi-V Transformer Coils form a matched ignition system, it delivers ample voltage while, at the same time, assuring reduced maintenance costs.

If you want facts on why important operators specify Bendix DLC Ignition, write: SCINTILLA DIVISION, BENDIX AVIATION CORPORATION, SIDNEY, NEW YORK. *REG. U.S. PAT. OFF.

Export Sales and Service: Bendix International Division, 205 E. 42nd St., New York 17, N. Y. *Canadian Affiliate:* Aviation Electric Ltd., 200 Laurentien Blvd., Montreal 9, Quebec. *Factory Branch Offices:* Burbank, Calif.; Orlando, Florida; Chicago, Ill.; Teaneck, New Jersey; Dallas, Texas; Seattle, Washington; Washington, D. C.

Scintilla Division
SIDNEY, N. Y.

Bendix
AVIATION CORPORATION



You who are responsible for the purchase of oil country tubular goods are assured highest quality when you specify Standard . . . the same product reliability as found in Standard's electric weld boiler and heat exchanger, pressure and mechanical tubing. Sizes: 2-⅜" and 2-⅞" tubing, 4-½" casing, also macaroni sizes. A.P.I. monogrammed.

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THE STANDARD TUBE COMPANY • 24400 PLYMOUTH ROAD, DETROIT 39, MICHIGAN

Welded stainless tubing and pipe • Welded carbon steel mechanical • Boiler and Heat Exchanger • Exclusive rigidized patterns • Special Shapes • Oil Well Tubing and Casing • Light Weight Pipe • Steel Tubing—Sizes: ¼" OD to 6" OD—.028 to .270 wall • Stainless Pipe and Tubing—Sizes ¼" OD to 4½" OD—.020 to .187 wall.

"Saves space... costs less, too"

W-K-M Cross-Type Multiple Completion Valves feature through-conduit gate construction, Teflon seat inserts for Double Tight sealing, pressure seal bonnets, superfinished stems supported on roller bearings, seating surfaces sealed from the lading flow. They can be overhauled on the line.

Sizes: 1¾" and 2"

Working Pressures: 2000, 3000 and 5000 pounds.

PRODUCT OF W-K-M's
Creative Engineering

W-K-M® Cross-Type Multiple Completion Valves

These compact new valves simplify tree construction. They cost less than conventional tree components, yet provide all the outstanding features found in W-K-M's world-renowned oilfield gate valves.

W-K-M integral cross-type valves are available for dual and tripie completions.

Next time — and every time — specify W-K-M! *At leading supply stores everywhere.*

WRITE FOR CATALOG 200

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DIVISION OF ACF INDUSTRIES
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P. O. BOX 2117, HOUSTON, TEXAS

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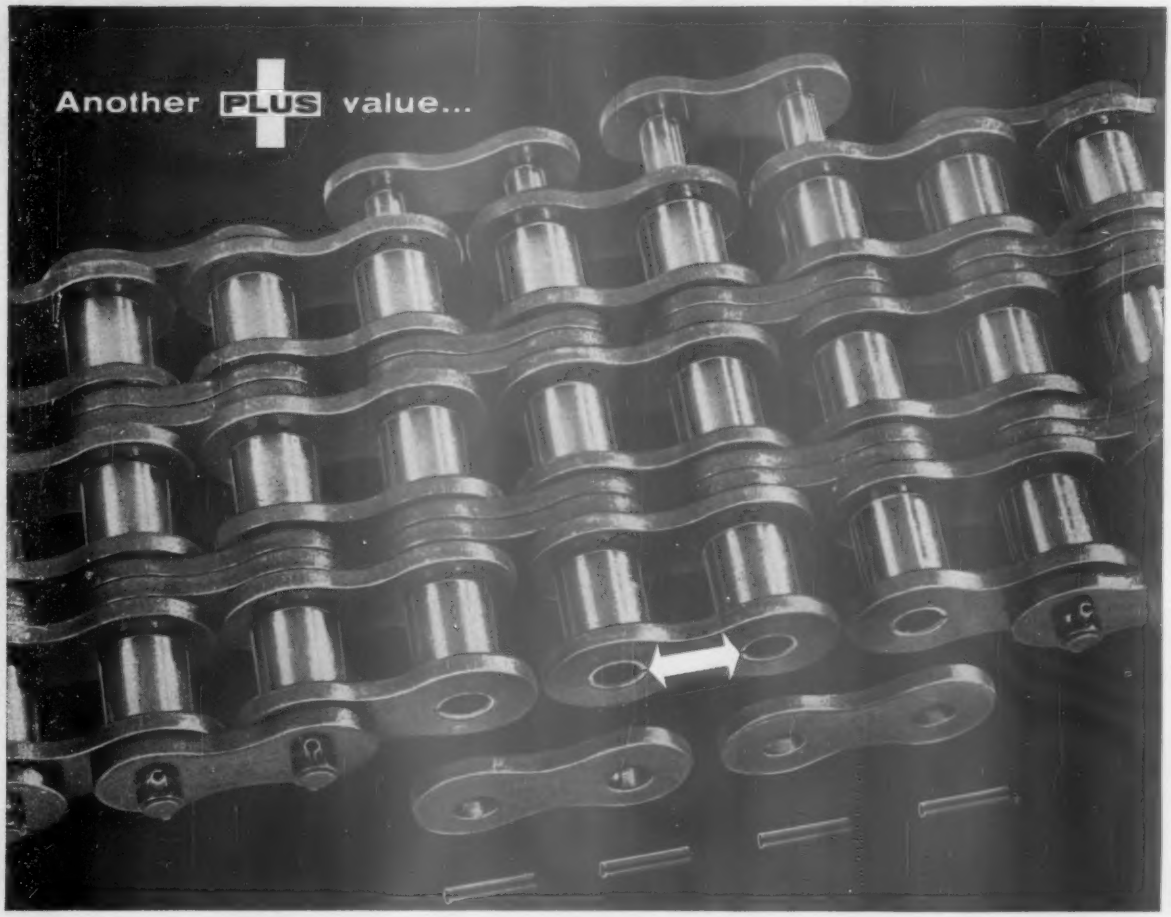

POSITIONED BUSHINGS FOR EXTRA FATIGUE STRENGTH

For the extremely high speeds of modern drilling service, bushings in an oil field roller chain are highly critical parts if long life is to be assured.

In Rex Oil Field Roller Chains, special design and manufacturing techniques have been developed to provide maximum fatigue strength. Inside diameters of the bushing are accurately round and seams are properly positioned in the link plates to maintain full bearing contact with the pin. The seams always face each other on the pitch line so that the load is always on the strongest part of the bushing.

For longest life... highest fatigue strength, get the chains that give you ALL the *plus* values: Rex Roller Chains. Available in GLIDE-FIT (cottered) and DRIVE-FIT (riveted) styles. CHAIN Belt Company, 4619 W. Greenfield Ave., Milwaukee 1, Wis.

Get ALL the Plus Values

- Pitch control
- Guide-pierced and ball-swaged link plate holes
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- Positioned seam bushings
- Oil holes for effective lubrication
- Gap-free round rollers
- Roll pin fasteners... proved best

For Highest Fatigue Strength ...Longest Wear Life

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Motors and Generators....that's our Business!

ME*

can do!

During your next planning pow-wow on a forthcoming project, consider this challenge (ME* Can Do!) from a tribe of "Injun-eers" who make motors and generators their only business . . . and who have been successfully conducting this business on product merit for nearly 50 years.

Feathers in our bonnet include some of the world's most honored projects and our scalp belt includes a multitude of the leading names in industry, but the Chiefs at ME* are more interested now in what ME* can do . . . for you!

Wherever you are, whatever your requirements, there's an ME* Sales Engineer ready to visit your reservation, sit in at your council fire and discuss your requirements . . . help you with your planning . . . prove the superiority of Marathon Electric Motors and Generators

This data and specification file on Marathon Electric Motors and Generators is now available for your ready reference use. May we mail you your free copy now?

Marathon Electric

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Right doping of tool joints and drill collar connections is a *must* for drill string thread protection.

The compound must spead completely around the threads but must not harden or squeeze out under high-pressure or temperature. It must remain soft in the can at all temperatures and in all weathers for easy, time-saving application.

WECO Tool Joint Compounds, Zinc-base No-Gall and Lead-base Lo-Tork, meet every requirement for right doping. Finely screened pure metallic zinc or lead is dispersed in a neutral oil with a tacky additive for real thread protection. WECO Compounds never require thinners and are not affected by extremes of hot or cold weather.

Dope your string right! See your Supply Store for **No-Gall**, 50% pure metallic zinc base, or for **Lo-Tork**, 50% metallic lead base . . . the best thread protection your string can have.

C-2-58

WECO

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

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JONES

FIRST IN 1894...

S. M. JONES.
COUPLING FOR PIPES OR RODS.
Patented Oct. 30, 1894.

Inventor.
Samuel M. Jones,
By Watson E. Coleman Hall
His Attys.

"Be it known that I, Samuel M. Jones, a citizen of the United States, residing at Toledo, Lucas County, Ohio, have invented certain new and useful Improvements in Couplings for Pipes or Rods, of which the following is a specification."

So reads the opening paragraph of Patent No. 528,168 granted October 30, 1894 . . . this was the beginning of JONES specialization...

FIRST TODAY...

Now, precision is the word for Jones couplings and sub-couplings. Made in two finishes... "Soft" and "Hardened and Ground", Jones couplings are finished and quality-controlled to API specifications. For the very finest in low cost oil recovery, continue to use Jones sucker rods and couplings... the products of recognized specialists.

...because we're Sucker Rod Specialists!

There are four
JONES JOB-ENGINEERED SUCKER RODS...
a type for every pumping need!

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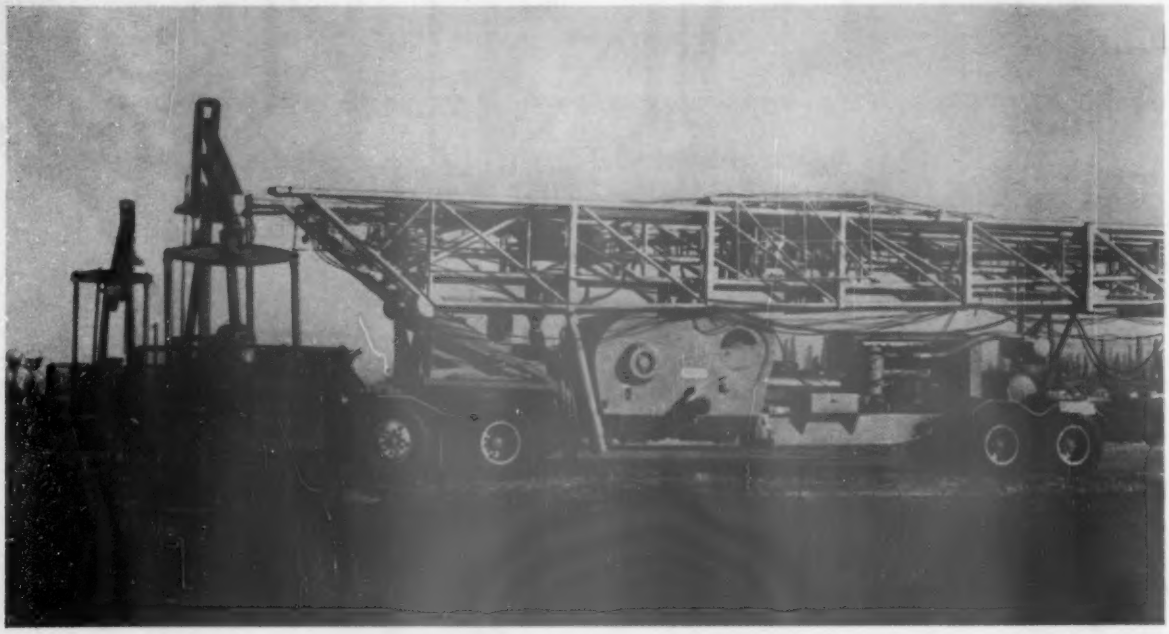
IDECO, One of the Dresser Industries, Dallas—New York

Franklin Supply Company, Export Division, Inc., New York

Better products, *faster,* from your National Seal distributor:



National Oil Seals cost little and afford big protection to your rig investment

National Seals keep lubricant where it belongs . . . shut out damaging dirt and corrosion moisture to lengthen bearing life

You can count on National Oil Seals to guard your equipment against costly bearing failures. In *Micro-Torc* leather seals, the leather is specially processed to give the best bearing protection. National *Syntech* rubber seals are specially made to meet the most exacting conditions of temperature, shaft speed, and other critical factors.

Whichever type or size you need, you can be sure of getting the right seal for every application. Your National Seal distributor gives fast delivery on the complete line. Call him today.

NATIONAL OIL SEALS

FEDERAL-MOGUL SERVICE

DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC. • DETROIT 13, MICHIGAN

ORIFICE METERS

American-Westcott Dri-flo and mercury manometers in recording, indicating and integrating models—to 5000 psi working pressure.

GASCLOK

Gas or air-operated instrument power drive and timing unit for remote installations.

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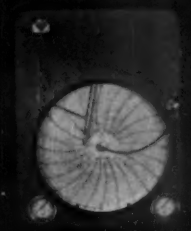
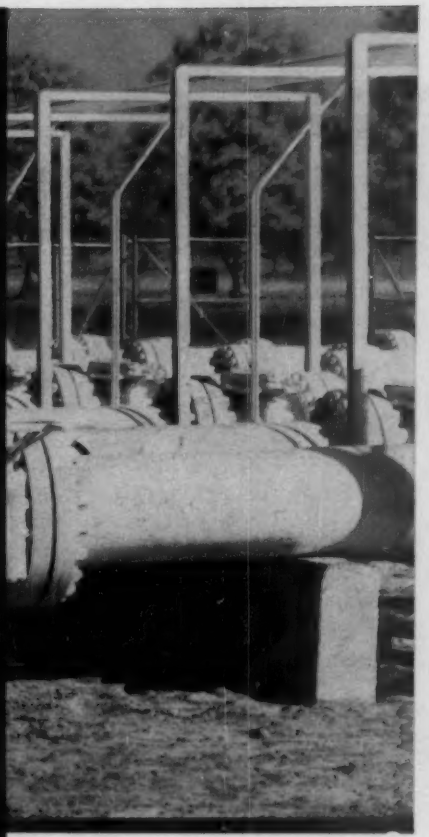
Controlled flow capillary meter pens record up to a full year without refilling—eliminate chart smearing and blurring.



CONTROLLERS

Series A-88 Controllers, Transmitters & Receivers for control of continuous process variables. Telemetering Systems designed to meet your requirements.



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American's complete line of equipment sets the highest standards for accuracy and dependability. Ask your American representative about their applications and advantages for your measurement and control problems.

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METER COMPANY
INCORPORATED ESTABLISHED 1836

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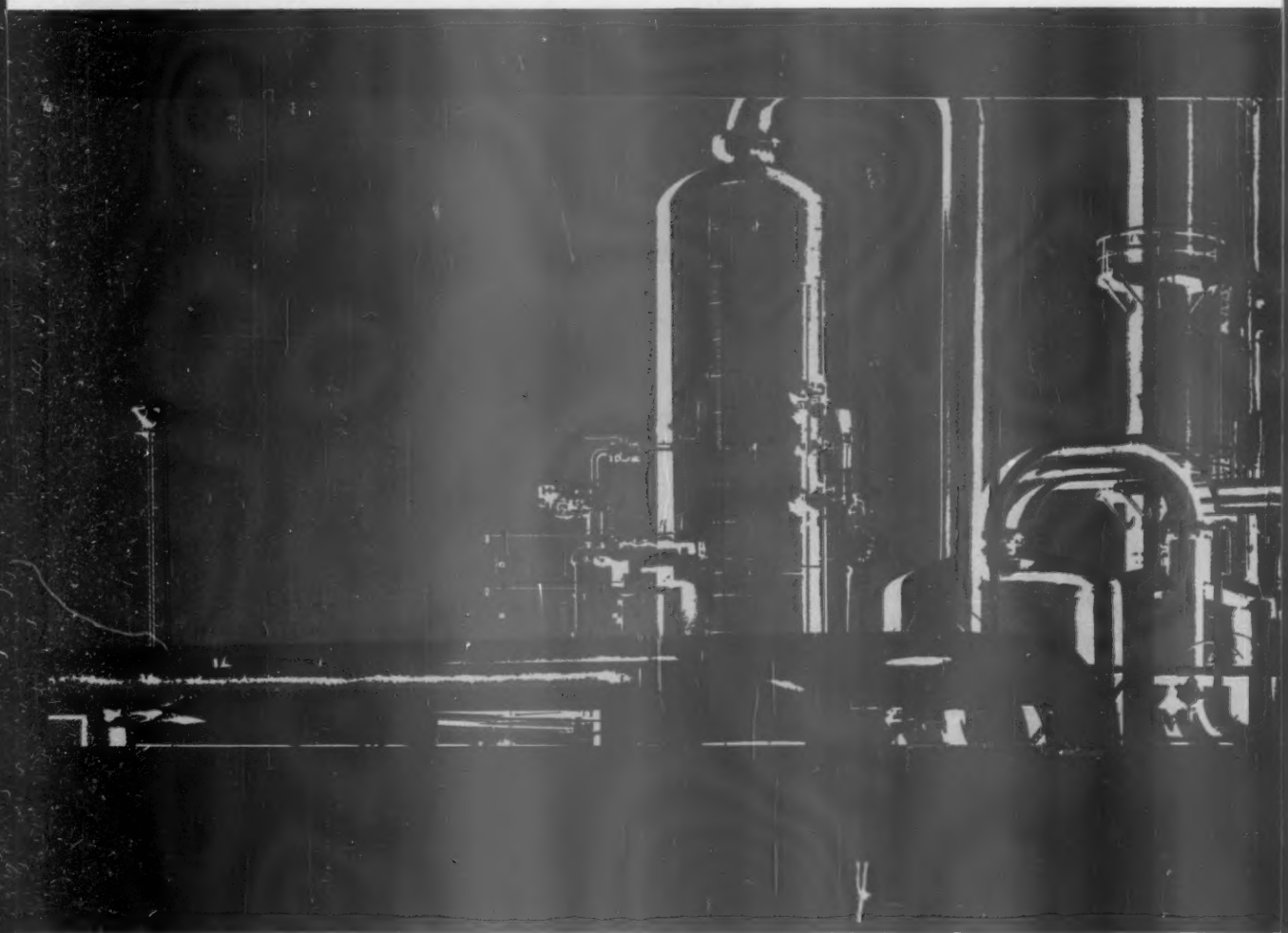
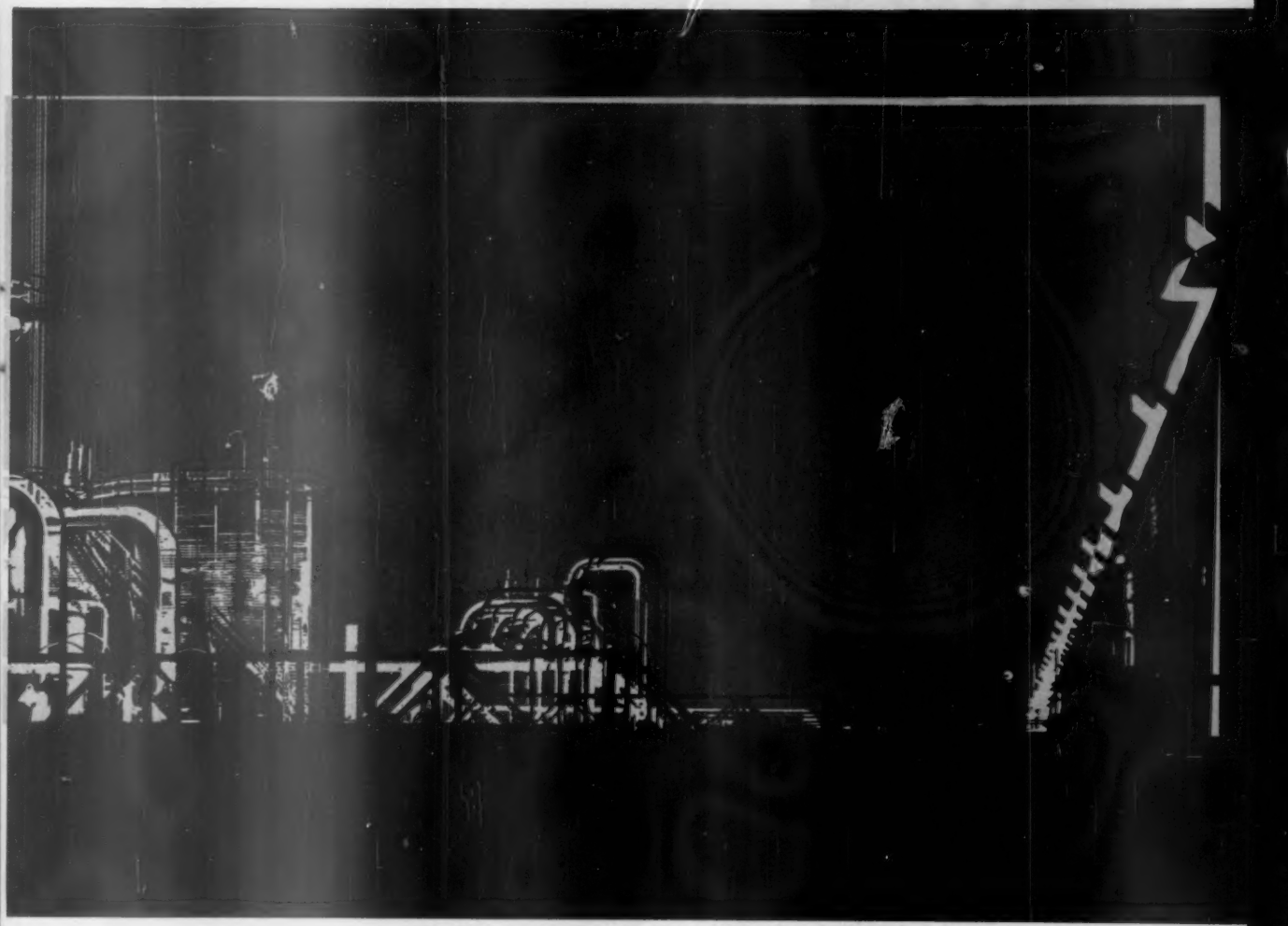


Dead or alive?

Each time tubular trouble jolts production to a standstill, you've got a half-dead refinery on your hands. And that means lost production time, maintenance or replacement costs, and missed delivery dates!

National Tube has 24 different ways to help you keep a refinery alive. Our 60 years of dealing with tubular problems has made it possible to develop 24 seamless steel pipe and tube analyses—each designed for a specific set of refinery conditions such as exposure, oxidation, acids, corrosion, high pressures, and elevated temperatures. Other analyses are available in tubular form and a wide variety of high temperature problems are under study.

We also have a trained Mill Service Force available for field consultation. These men are ready to help you find the right alloy,



at the right price, to meet your needs. So stop trouble before it starts. Get complete details by writing National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS is registered trademark

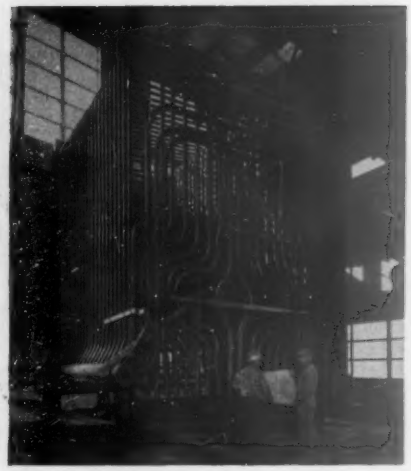
Here are National Tube's two dozen different tube analyses:

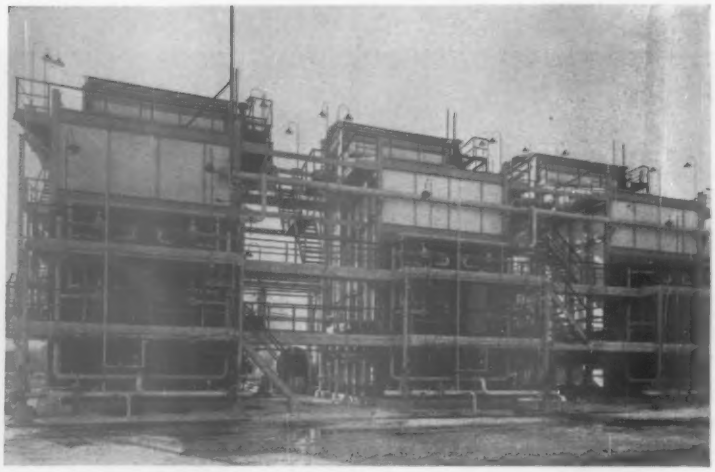
Carbon	5 Cr, ½ Mo	17 Cr
Carbon, ½ Mo	5 Cr, ½ Mo, 1½ Si	18-8
1 Cr, ½ Mo	7 Cr, ½ Mo	18-8 Ti
1¼ Cr, ½ Mo	8 Cr, ½ Mo	18-8 Cb
2 Cr, ½ Mo	8 Cr, 1 Mo	18-8 Mo
2¼ Cr, 1 Mo	9 Cr, 1 Mo	25-20
2½ Cr, ½ Mo, ¾ Si	12 Cr	3½ Ni
3 Cr, 1 Mo	12 Cr, Al	5 Ni

The world's largest and most experienced manufacturer of tubular products

National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Supply Division, United States Steel Export Company, New York





AT LEFT: Installing a 60,000 lbs/hr unit in a brewery

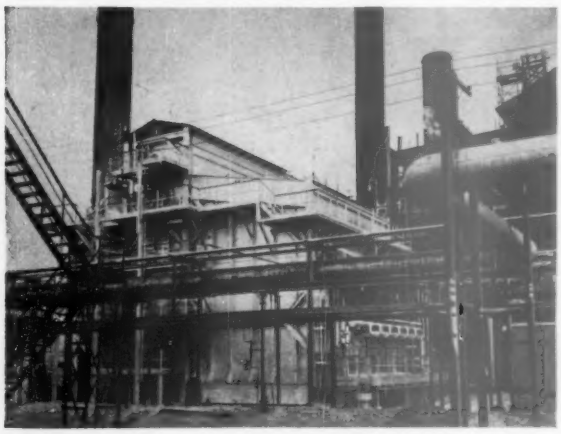
ABOVE: A battery of 125,000 lbs/hr units in a chemical plant

CUSTOM *Steam* **GENERATORS by Vogt**

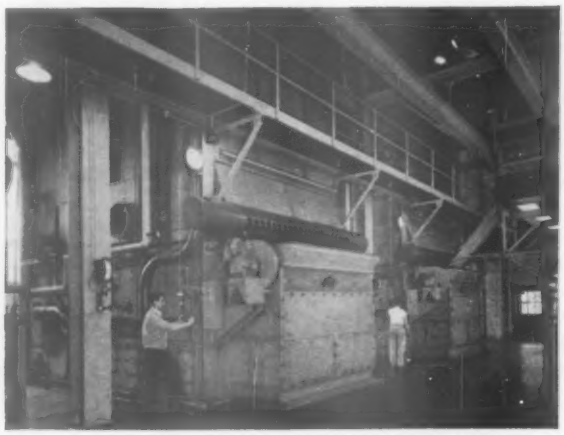
Vogt engineering advances can save you money if you have a steam generating problem. Custom-built installations shown, are engineered to assure efficient, dependable steam generation for power, process and heating. Our engineering staff is available to give effective help in the solution of steam generating problems peculiar to a wide variety of operating conditions. Address Dept. 24A-BO.

HENRY VOGT MACHINE CO.
LOUISVILLE, KENTUCKY

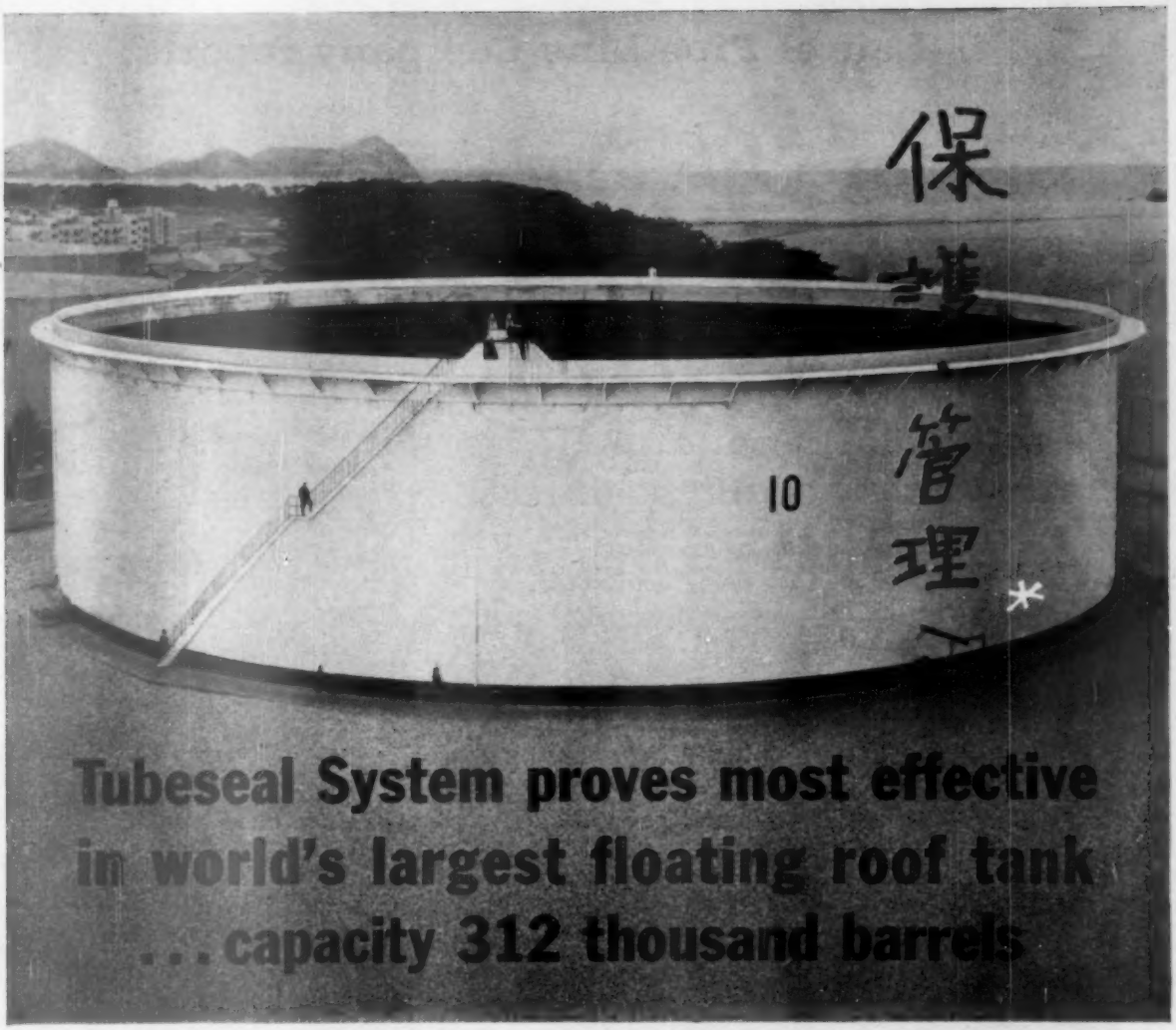
SALES OFFICES: New York, Chicago, Cleveland, Dallas, Camden, N. J., St. Louis, Charleston, W. Va., Cincinnati



This 400,000 lbs/hr unit is installed in a leading petroleum refinery



Three 40,000 lbs/hr units serve a medical center



Tubeseal System proves most effective in world's largest floating roof tank . . . capacity 312 thousand barrels

Conservation is the same in any language . . . and in any country where petroleum or chemical products are stored, conservation can contribute substantially to profitable operations.

In Japan the General Oil Company installed the world's largest Floating Roof Tank—210 feet in diameter, to store 312,000 barrels of gasoline. Significantly this tank is equipped with the renowned Hammond Tubeseal System†. This is one of more than a hundred Hammond Tubeseal Systems operating in Japan.

This Tubeseal floating roof tank, like the many hundreds operating everywhere throughout the free world, found wide and enthusiastic acceptance because of its effective protection against losses by evaporation, product contamination, corrosion, fire and explosion. Tubeseal Floating Roof Tanks are safety-vaults for storage of the volatile products of your refinery or petrochemical plant.

Write for bulletin which tells the entire story.

* *The above ideographs spell Conservation*

† *Patented*

HAMONDTANK

12 plants to serve you coast to coast

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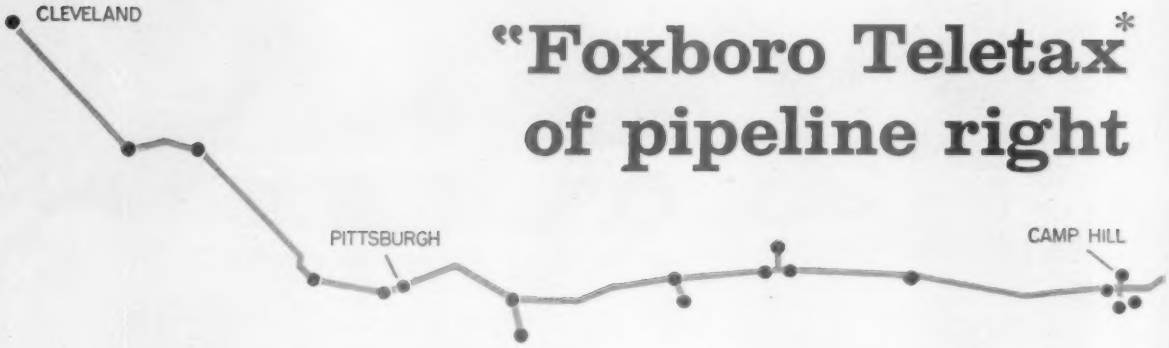
Laurel Pipe Line Company reports:

"Foxboro Teletax* of pipeline right



447-mile Laurel Pipe Line Company is owned by the Gulf Oil Company, the Sinclair Pipe Line Company, and Texaco, Inc. Line serves 22 terminals between Philadelphia and Cleveland—has a capacity of 160,000 bpd.

Central dispatching station at Camp Hill, Pa., is linked by microwave to the 62 Foxboro Teletax transmitters located along the 447-mile Laurel pipeline.

Foxboro M/44 pressure transmitter, sends signal to pumping station control room at rear while Teletax transmitter (in explosion-proof housing) beams pressure signal back to Camp Hill.

Telemetering puts 447 miles at our fingertips"

Deliveries to 22 terminals controlled from central dispatching station.

Foxboro Teletax Receivers on dispatchers' panel in Camp Hill, Pa., show 58 pressure and flow signals from pumping and metering stations along the line. Flow signals also go to totalizers on the boards, as well as to data logger next to dispatchers' desk.

PHOTOGRAPHY BY JOHN H. TROUP, JR., HARRISBURG

Picture a 24" to 14" pipeline starting in Philadelphia and ending in Cleveland, 447 miles away. Then picture 16 different petroleum products, belonging to 3 different oil companies, flowing to 22 delivery points. Picture this, and you understand the complexity of the Laurel pipeline.

To help Laurel dispatchers with their complex scheduling task, 62 Foxboro Teletax Telemetering Systems are employed. Transmitters are located at pumping and metering stations up and down the line; receivers at a central dispatching station in Camp Hill, Pennsylvania. Transmission is by company-owned microwave, supplemented at some locations by leased line circuits.

"Reliability was one of the chief concerns when installing our telemetering equipment," Laurel reports. "A high degree of reliability would allow us to adhere to predetermined delivery schedules — save pumping and manpower costs. In short, help operate the line more efficiently. And, with our Teletax systems, we've been getting that reliability."

Foxboro Teletax Telemetering systems are noted for their simplicity, their high sustained accuracy, as well as their reliability. They can be used with the most advanced transmission techniques. Write for Bulletin 17-11 — it gives all the details. The Foxboro Company, 604 Neponset Avenue, Foxboro, Massachusetts.

*Reg. U.S. Pat. Off.

FOXBORO

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GUIBERSON TYPE F

AUTOMATIC AIR OPERATED TUBING SPIDER

Handle any length tubing string . . fast . . safe . . sure

BIG, TOUGH, RUGGED, Guiberson Type F Spider makes it possible for one man to handle the longest, heaviest tubing string safely with no scoring or crimping of the tubing. Slips have a long, generous contact with the pipe. Slips maintain 3-point contact for automatic alignment, maximum stability, even load distribution.

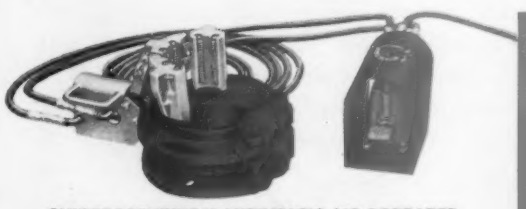
FAST AND SAFE, the Type F Spider speeds-up workover, completion jobs and slim-hole drilling with *hands-free* safety. Slips are released and retracted automatically by a remote control foot pedal, cutting time, eliminating the danger of hand operated slips. Slip inserts are easily and quickly replaced in the field.

SELECTOR ON THE FOOT VALVE provides: (1) single foot-pedal action, depress to retract slips, release to set slips or (2) double foot-pedal action, slips retract when pedal is depressed and released. Pedal must be depressed and released again to return slips to bowl. Both actions can be reversed by reversing hose connections at spider.

TWO OPERATIONAL PRESSURE RANGES are provided, 80-125 psi or 40-80 psi. Changing from one range to the other is a simple operation at the spider.

Save time . . gain extra safety . . with Guiberson Type F Spider . . get complete information from a Guiberson man or see it at your supply store.

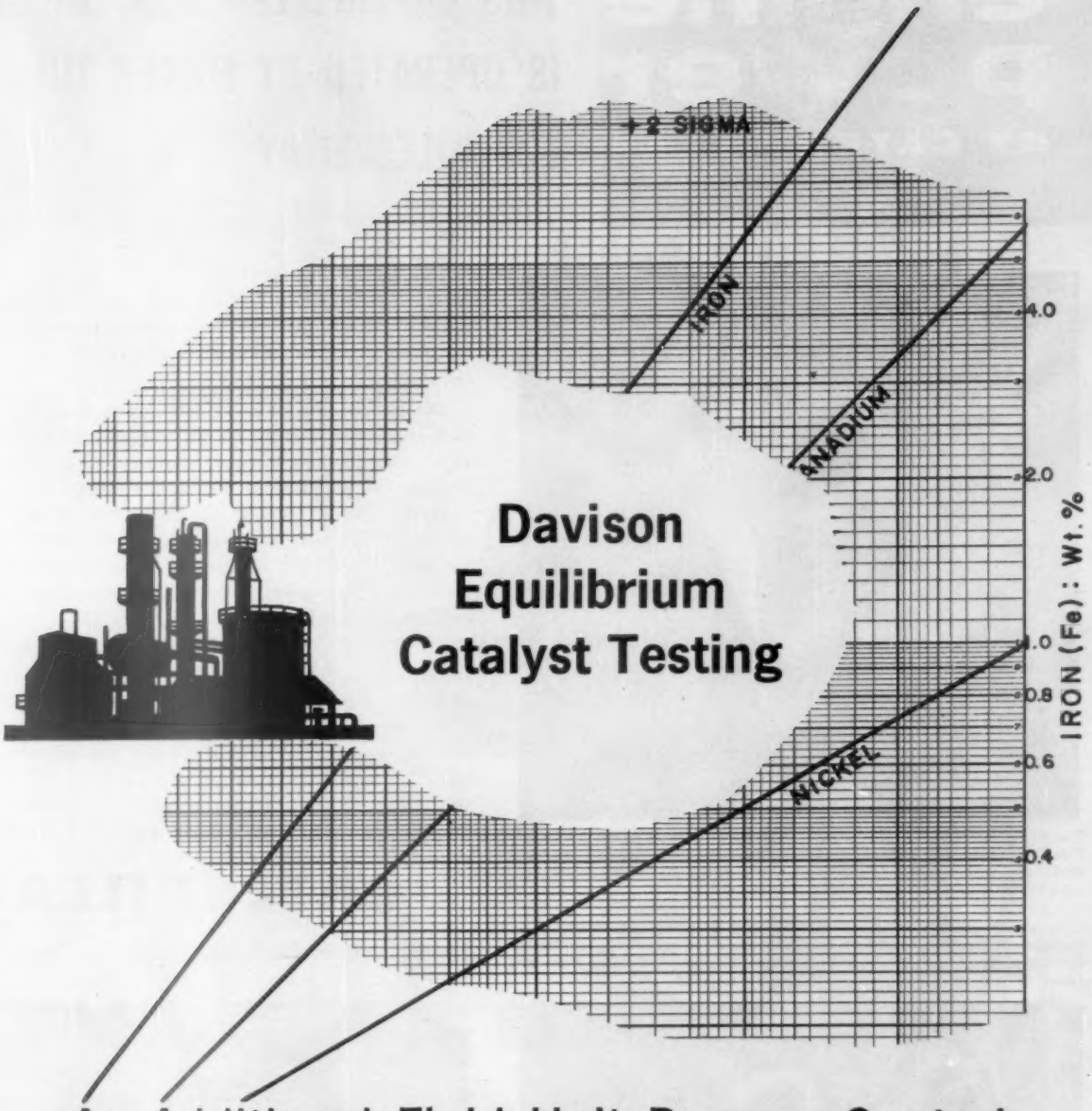
Sold by Oil Field Supply Stores Everywhere



GUIBERSON TYPE H AUTOMATIC AIR OPERATED TUBING SPIDER is a short, compact version of the Type F . . designed for medium depth wells up to 9,000′ for 2⅜″ O.D., 8,000′ for 2⅞″ O.D., or 6,000′ for 3½″ O.D. tubing.

THE GUIBERSON CORPORATION

ESTABLISHED 1919 — DALLAS, TEXAS U. S. A.



Davison Equilibrium Catalyst Testing

An Additional Fluid Unit Process Control

Improve *conversion—selectivity—regeneration—fluidization* with the aid of this valuable Davison service. More than half of the fluid unit operators in North America rely on Davison Equilibrium Catalyst Testing. Find out how you can benefit. Ask your Davison representative or write Department A-04.

DEPARTMENT A-04

W.R. GRACE & CO.

DAVISON CHEMICAL DIVISION

BALTIMORE 3, MARYLAND

engine power BY CATERPILLAR

THIS CATERPILLAR D397 DIESEL IS OPERATED BY FINGER TIP 122 MILES AWAY

The Cat D397 shown below is the sixth repeat order by this company's Pipeline Department. "The Caterpillar Diesel has reliability and economy that have proved to be very satisfactory for this pipeline application," says Division Superintendent V. J. Hansen.

This booster station on the pipeline system of a major midwestern oil company is located at Sauk Centre, Minnesota. It is remotely controlled from Moorhead, 122 miles away. It can also be controlled from any point on the system of leased telephone circuits.

Automatically controlled by dial code over leased telephone lines, this pumping station, powered by a Caterpillar D397, has a record of 99 per cent reliability.

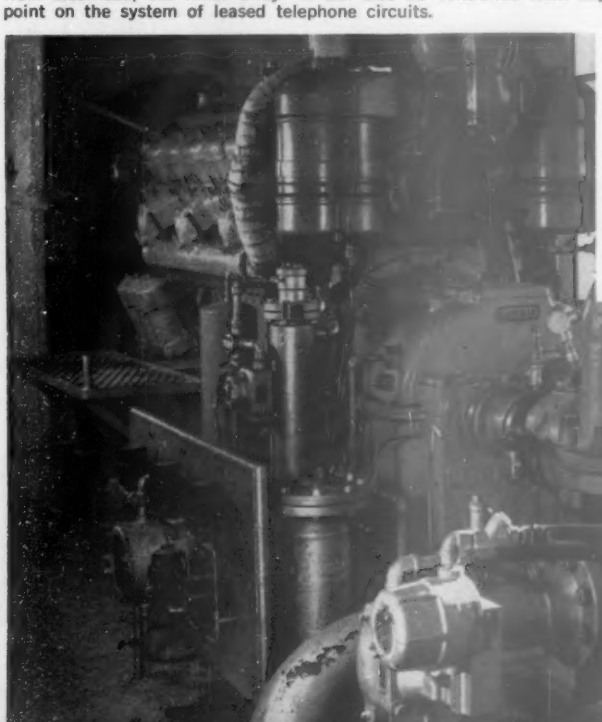
Diesel is preferred to electric power, first, because lack of electricity in the vicinity means high construction costs for the needed facilities. Second, with diesels, no standby or demand charges build up operating costs. And third, the better speed variability of diesels is more efficient for this installation because the station is downstream from a terminal that sometimes takes full receipts, sometimes only half and sometimes none.

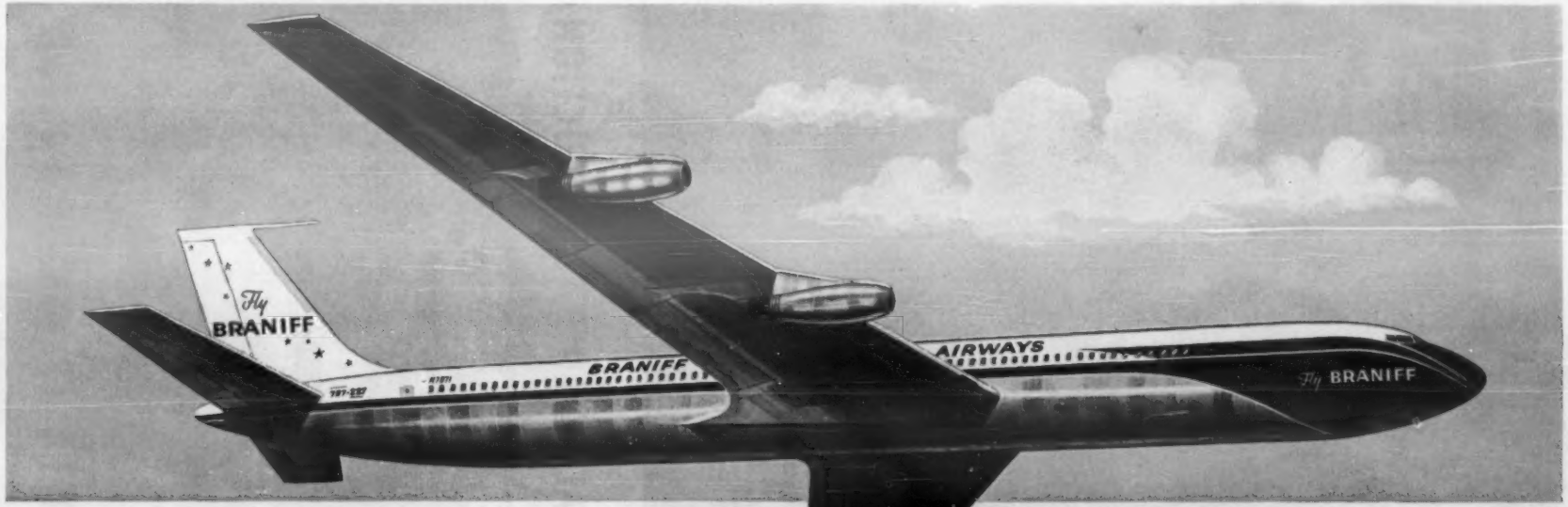
The Caterpillar Turbocharged D397 Diesel is rated 650 maximum HP. This engine is also available in 7.5:1 and 10.5:1 compression ratio Natural Gas versions for extra economy where this low-cost fuel is available. Your Cat Dealer will recommend the right power for your job from the 75 HP D311 to the big D397. Call him today. And remember to specify Caterpillar when ordering new equipment.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Engine Division, Caterpillar Tractor Co., Peoria, Ill.





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...the JET with the BIG engines

El Dorado Jet

FASTEST *--cruises over 600 m.p.h.*
POWER PLUS *--20% to 40% more*
ON-TIME *--the most power in reserve*
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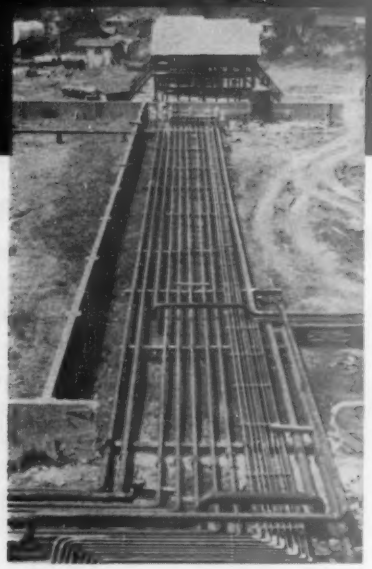
Call any Braniff office or your travel agent. General Offices: Dallas, Texas.

QUALITY PIPELINES



Another fine service of *LATEX* is the construction of MARINE & PIPELINE TERMINALS. *LATEX* offers personnel skilled in this phase of the industry.

LATEX QUALITY LINE CONSTRUCTION

LATEX offers line construction of the highest caliber. This statement is backed up by more than one quarter century service to the oil and gas industry. Repeating Business has been the keynote to success of this growing company. For your next quality line invite *LATEX*.

REMEMBER, LATEX QUALITY CONSTRUCTION BRINGS REPEAT BUSINESS

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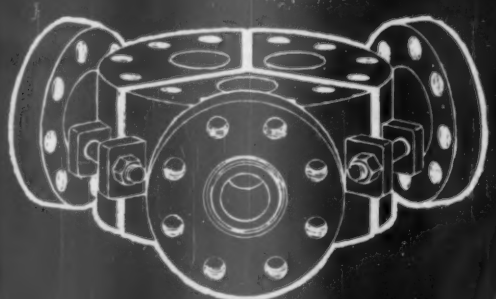
SERVING 1/4 CENTURY

LATEX CONSTRUCTION COMPANY

P. O. BOX 12128 • ATLANTA 5, GEORGIA • CE 3-9414

The Ultimate in Flexibility for Triple Completions



TRI FLANGED TEE

THE O·C·T TRI FLANGED TREE

There is *no* doubt about the payout when three good zones can be flowed through one wellhead. There *is* doubt when you use a jumble of complicated equipment.

The O-C-T Crescent Flange Tree is tailored for dual completions. And now we are proud to present the "Tri Flanged Tree" tailored for triple completions.

Like the Crescent, the "Tri Flanged Tree" offers the ultimate in *flexibility, simplicity* and *economy*. One valve in this triple hookup can be removed without disturbing the remaining two valves. Or, if necessary, any two valves can be removed without disturbing the third.

If there is a multiple producer on your horizon, talk to the O-C-T representative nearest you. He can solve your equipment problems before the problems arrive.

where progress is a daily practice

O·C·T

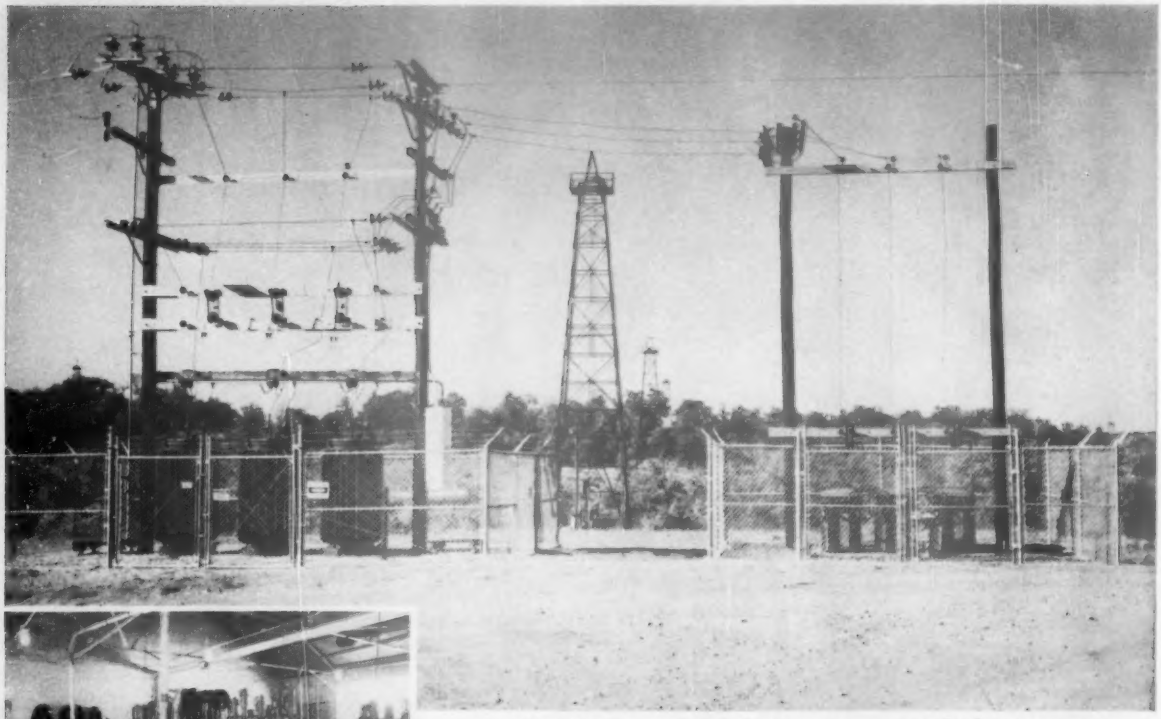
OIL CENTER TOOL CO.

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

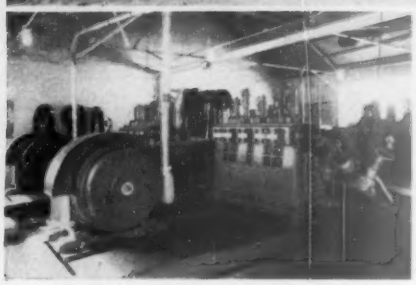
Address Export Inquiries for All Countries to
P. O. Box 3091, Houston, Texas.

You can depend on purchased electric power for

VERSATILITY

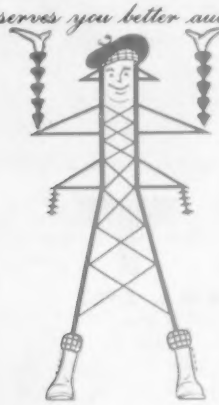


Substation for purchased electric power on waterflood project.



Substation above supplies current for these two big electric motors driving pumps for waterflood project.

Purchased Electric Power . . . saves money, manpower, maintenance, and serves you better automatically



The versatility of utility electric power makes it ideal for many types of application in production, pipelines or refineries.

The modern trend to automation and remote control is made easier with versatile purchased electric power. Whatever your particular power requirements are, you will usually find an economical answer to your problems with purchased power. Why not call your nearest utility electric power company today for possible assistance.

Petroleum Electric Power Association

P. O. BOX 35006, DALLAS 35, TEXAS

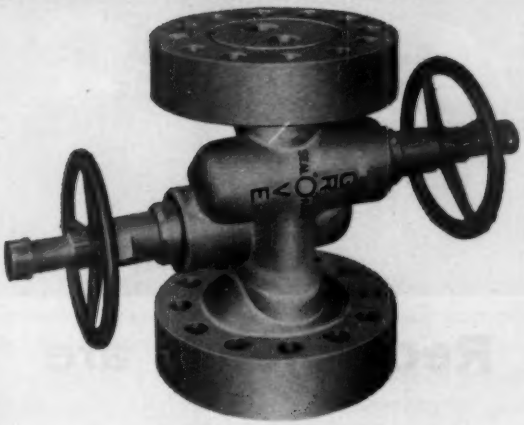
These Grove G-2 Seal-"O"-Ring® Valves *RIGHT OFF THE SHELF*

These Grove series G-2 production valves are available right now in most sizes — more coming. They feature Grove Seal-"O"-Ring design and the Grove Valve **big plus** — no lubrication ever!

STANDARD GROVE G-2

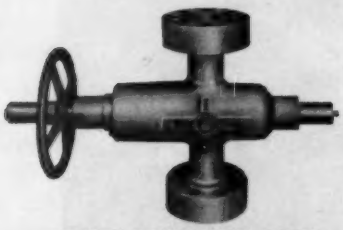
Right-now shipment of standard series G-2 valves. Available in either flanged or screwed end. Sizes: 1½" through 4". Working pressure: 1000, 2000, 3000 and 5000 pounds.

Write for Bulletin #581



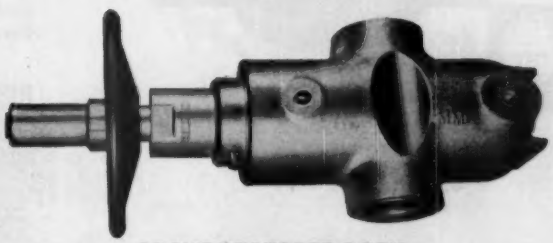
GROVE DUAL BLOCK

Available in 2" — 5000 #W.O.G.



GROVE BALANCED STEM

Available in 2" x 1⅜", 2" x 1-13/16", 3" x 2-1/16", and 3½" x 2-9/16" — 10,000 #W.O.G.



GROVE RECESSED BODY

Available in 1½" and 2" — 2000, 3000 and 5000 #W.O.G.

GROVE PRODUCTION VALVES

GROVE VALVE and REGULATOR COMPANY

A Subsidiary of Walworth

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Tulsa • Denver • Chicago • New York • Dallas
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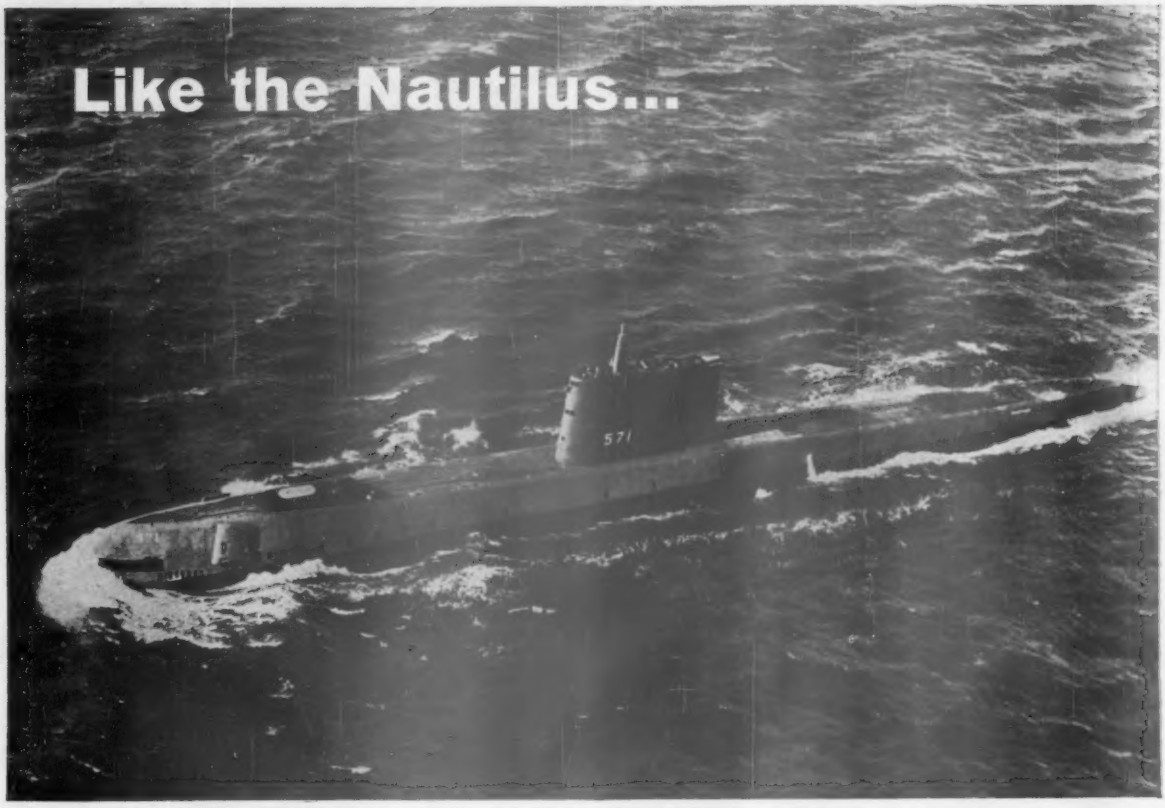
6321



Rectorheads are *"Sealed With Steel"*

Rector pioneered the welded seal principle in casing heads . . . the same principle of welding that is used in the construction of today's atomic submarine "Nautilus," built to withstand extreme temperature variants, torque, and tremendous pressure as it cruises the ocean depths.

Rector's welded seal plus API Ring Gasket, never requires replacement or maintenance. Well or "Frac" pressure cannot be transmitted to the slips where hydraulic pressure can collapse or crush pipe. Rector casing heads are built to withstand fire, shock, freezing temperature and highest well-head pressures. The soundness and complete efficiency of application and service of the Rector welded seal has been proven in over 100,000 trouble free field installations.

RECTORHEADS are available in sizes through 20". See your Rector representative or order from your favorite supply store.

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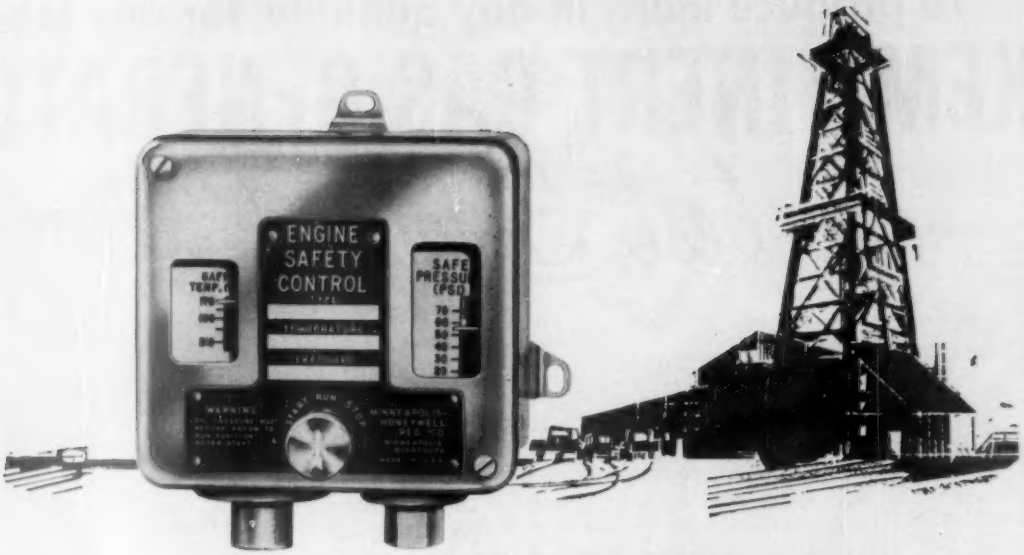
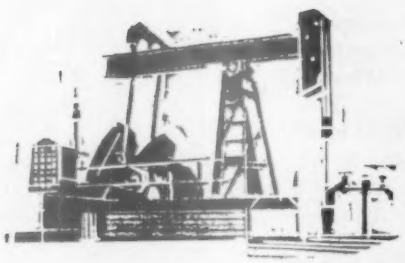


ELIMINATE OIL PRESSURE AND ENGINE TEMPERATURE DAMAGE



Protect your investment with Honeywell's fail-safe controller . . . especially vital for unattended engines. Why risk severely damaging *even one* engine because of over-heating or loss of oil pressure? By installing Honeywell's combination engine safety control, you'll help put a stop to costly repair bills and downtime. It's better than having an operator there to stop an engine or sound an alarm when trouble starts.

Honeywell's P618 engine safety control will never fail you. Temperature and pressure settings won't drift off set points because this is an *industrial* instrument for *industrial* applications with heavy-duty construction that is vibration-resistant. The patented fail-safe feature always assures a shutdown even if the bulb or capillary is damaged. Large "picture" windows and calibrated dial keep settings easily visible without removing cover. New and different, there's nothing like it!

For complete information, contact your local Honeywell office or write: Minneapolis-Honeywell, Dept. OJ-4-21, Minneapolis 8, Minn.

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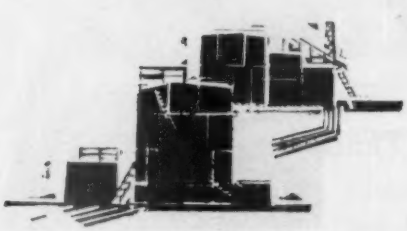
Honeywell

H — First in Control — SINCE 1885



To produce inerts in any quantity, for any job . . .

KEMP INERT GAS GENERATORS

—are best 3 ways!

1. Easy to start, set and forget

With Kemp's unique carburetor and external test burner, you check the pre-mixed gas-air ratio *before* it enters the combustion chamber . . . start fast with the electric ignition. Then set the vernial dial and forget it! The carburetor maintains the exact air-gas ratio—no rechecking needed.

2. Precise fuel control

You'll find the Kemp Carburetor automatically pre-mixes and keeps gas and air at the exact mixture you wish. And no matter what the total demand or pressure changes in your supply line, this precise air-gas ratio is maintained at all times.

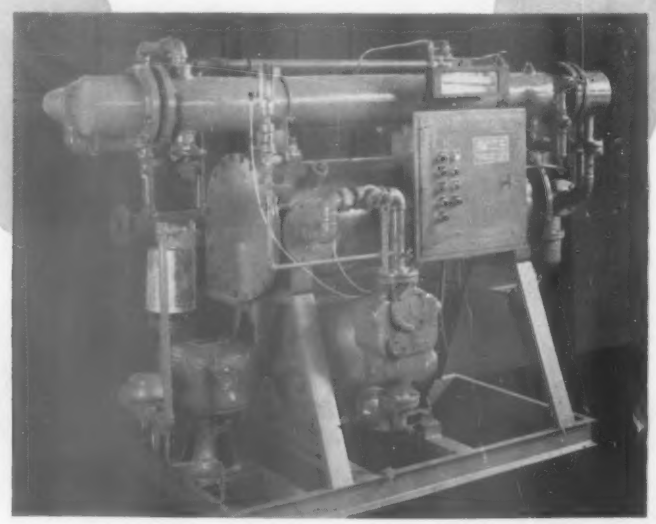
3. Automatic safety

Kemp safety controls eliminate the danger of flame-out. An electronic flame-failure control instantly, automatically cuts off the carburetor's gas supply. This control operates under all conditions . . . unaffected by moisture or combustion chamber pressure.

If you need inert gases for blanketing, purging and protective uses, write for Bulletin L-10 . . . or call in your Kemp Man listed in the yellow pages or the Chemical Engineering Catalog.

It always pays to come to

KEMP
OF BALTIMORE



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These three new Ajax Full Dollar Value Single Engine Compressor Units have been designed to help you buy closer to your actual needs with a reasonable margin of power reserve.

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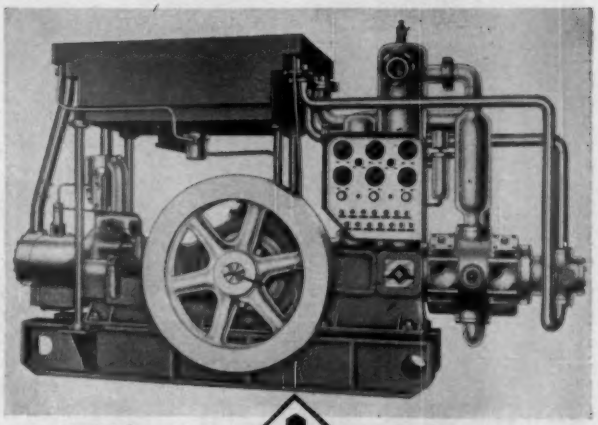
Equipment investment costs are more critical today than ever before.

Let Ajax engineers work with you to determine your real needs and minimum investment for maximum returns from equipment and equipment investment.

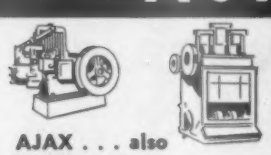
Send for detailed technical specifications brochure today.



THE *NEW* DPC-60 ENGINE-COMPRESSOR UNIT

AJAX

AJAX COMPRESSORS



AJAX . . . also builders of ENGINES . . . PUMPS

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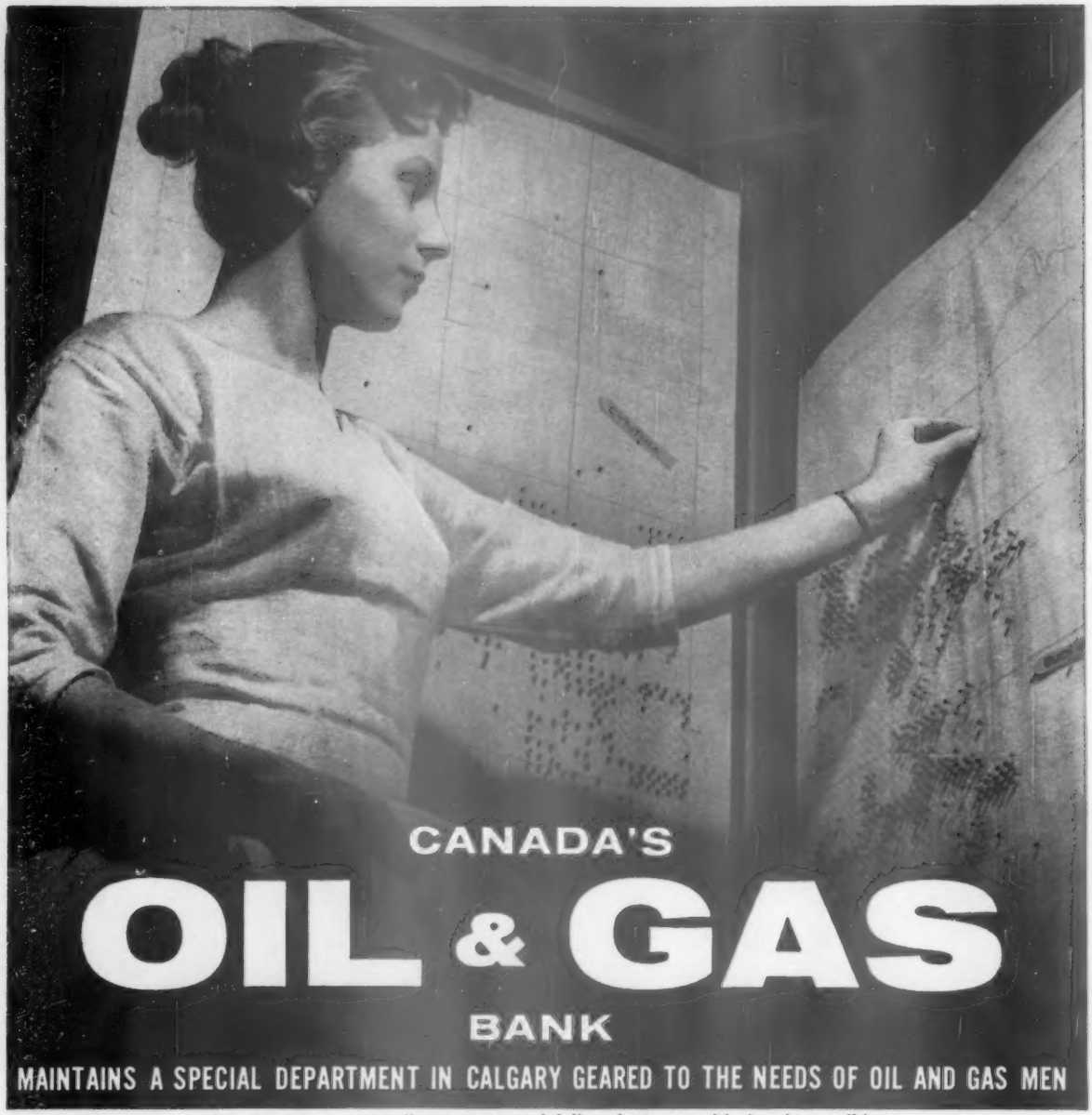
OIL FIELD DISTRIBUTORS: The National Supply Co., Pittsburgh, Pa.
• Bethlehem Steel Co. — Supply Division, Tulsa, Oklahoma



Oil & Gas Department well maps are posted daily to keep pace with changing conditions.

The officers who staff our Oil and Gas Department in Calgary are "oil bankers" in every sense of the word. By experience and training, and through a specialized knowledge of the business, they are exceptionally well qualified to facilitate and coordinate the many services called for by this fast growing Canadian industry.

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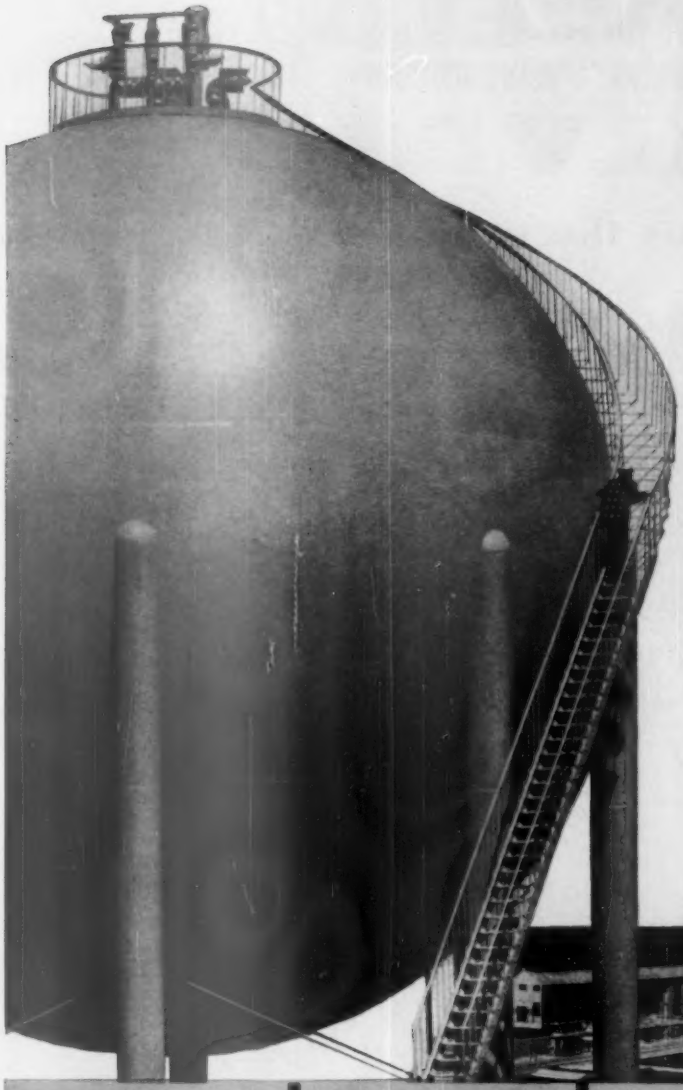
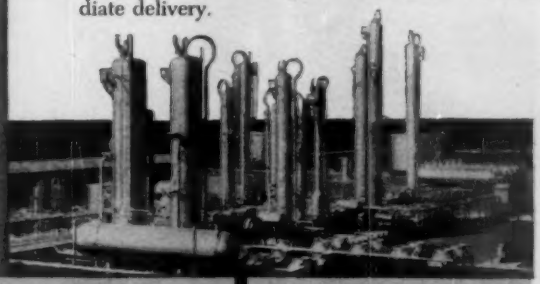


Tough, colorful, lasting beauty!

Take those pumps and rigs in the oil fields—or those tanks and pipelines in the refineries! Each needs the tough, colorful, lasting beauty that Rust-Oleum provides. If the surface is rusty, Rust-Oleum 769 Damp-Proof Red Primer can be applied *right over the sound rusted surface* after removing rust scale and loose rust. Special Rust-Oleum Oil Field Finishes match the original equipment colors on pumps and rigs – while other long-lasting Rust-Oleum coatings protect costly tanks and pipe lines.

They're specially made for oil field use – tough, flexible, easy-to-use on the spot by brush or spray! They dry to firm, glossy finishes that resist sun, fumes, heat, moisture, weathering, and blowing dust and sand.

Try Rust-Oleum . . . your Rust-Oleum Distributor maintains complete stocks for immediate delivery.



Apply Rust-Oleum 769 Damp-Proof Red Primer directly over sound rusted surfaces.

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By brush or spray – the Rust-Oleum system provides tough, colorful, lasting beauty.

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VALVES

Performance makes the world of difference

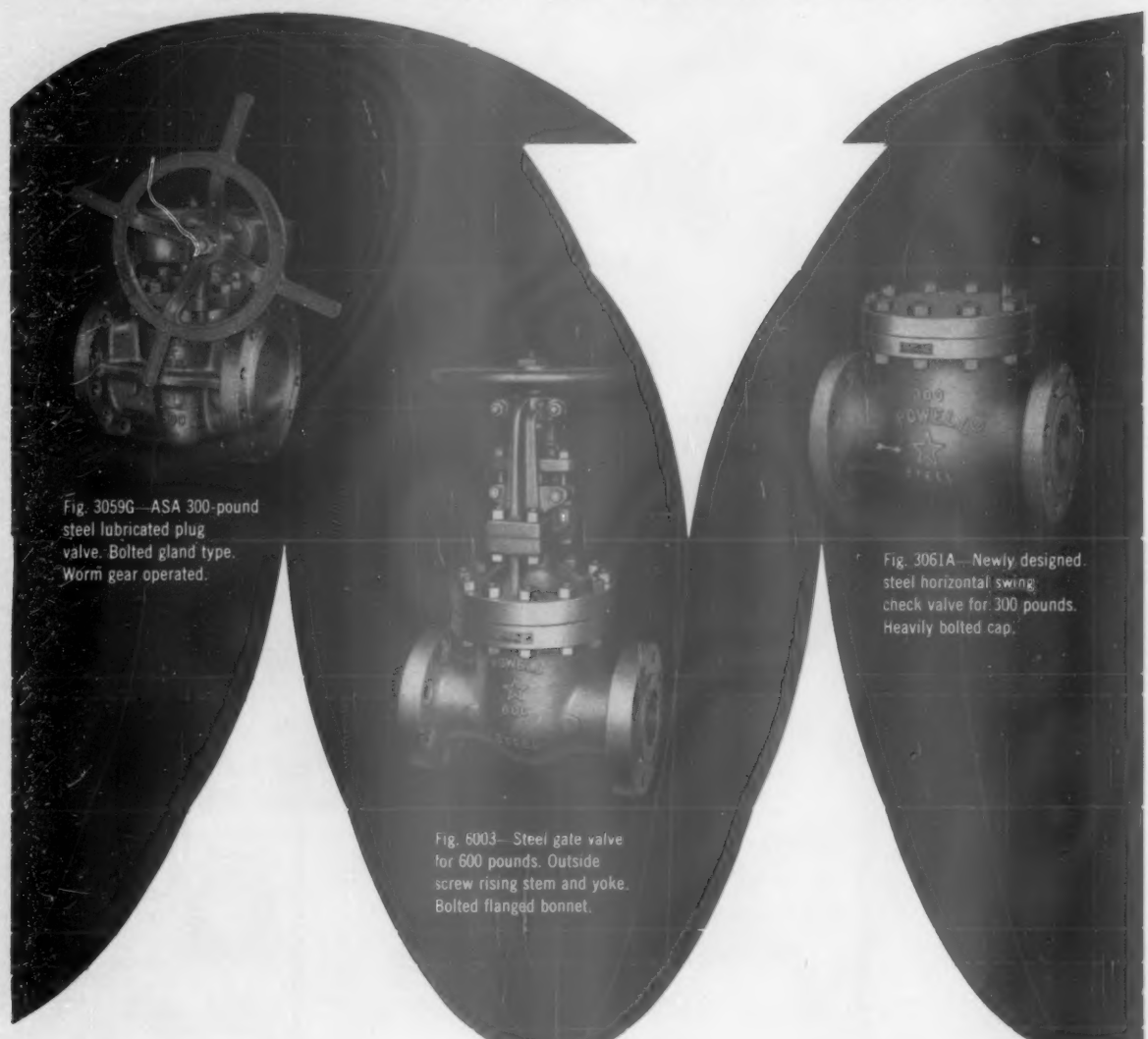


Fig. 3059G—ASA 300-pound steel lubricated plug valve. Bolted gland type. Worm gear operated.

Fig. 6003—Steel gate valve for 600 pounds. Outside screw rising stem and yoke. Bolted flanged bonnet.

Fig. 3061A—Newly designed steel horizontal swing check valve for 300 pounds. Heavily bolted cap.

Powell steel valves have been performance proven for more than a century in controlling the flow of fluids in refineries, petrochemical plants and storage facilities.

Also, there are Powell Valves in bronze, iron, pure metals and special alloys for handling water, oil, gas, air, steam and corrosive media. So whatever your flow control need may be, you can depend upon a Powell Valve to take care of it.

Contact your nearest Powell Valve distributor or write directly to us. Our experienced engineers will help you to satisfactorily solve any of your valve problems.

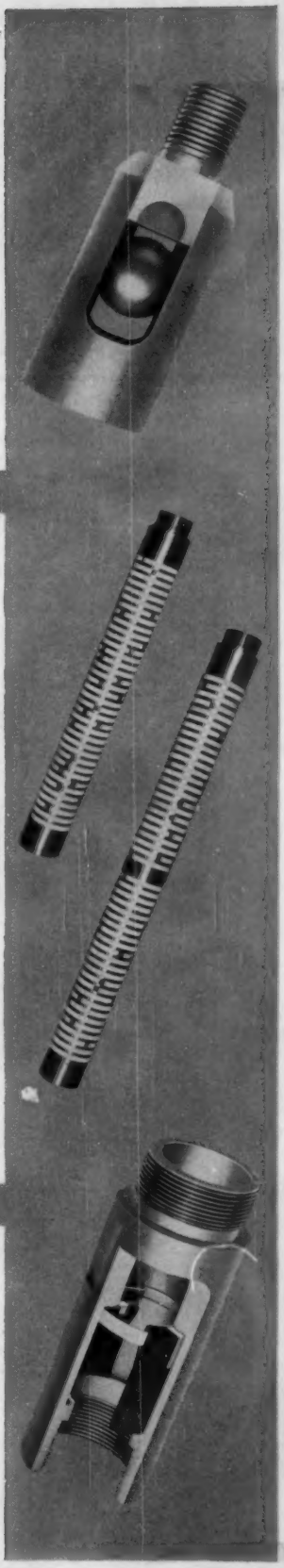
Powell . . . world's largest family of valves

THE WM. POWELL COMPANY • DEPENDABLE VALVES SINCE 1846 • CINCINNATI 22, OHIO

Let R-u-b-b-e-r Take The Wear

in your sucker rod pumps

It Costs You Less That Way



Both **MARTIN PLUNGERS** and **MARTIN RUBBER GUIDE CAGES** are the result of correct engineering to fully utilize the excellent properties of rubber.

In the **MARTIN SPLIT RINGS,** even the swelling of natural rubber in oil is utilized in sealing the split and tightening the rings in the PLUNGER GROOVES. **Resistance to abrasion** greatly prolongs plunger life in sandy conditions. **Slippery when wet** means that you have lubrication, even when pumping all water. Barrel life is increased because this material cannot score or gall metal.

For the **REPLACEABLE RUBBER GUIDES** in cages, **oil resistant** synthetic rubber is used. No swelling can be tolerated here. **Resilience** completely eliminates the beating action of the ball, and greatly increases ball life. **Resistance to abrasion** reduces wear on both guide and ball.

CUT YOUR COSTS . . . LET RUBBER TAKE THE WEAR . . . Write for our new 1960 catalog.

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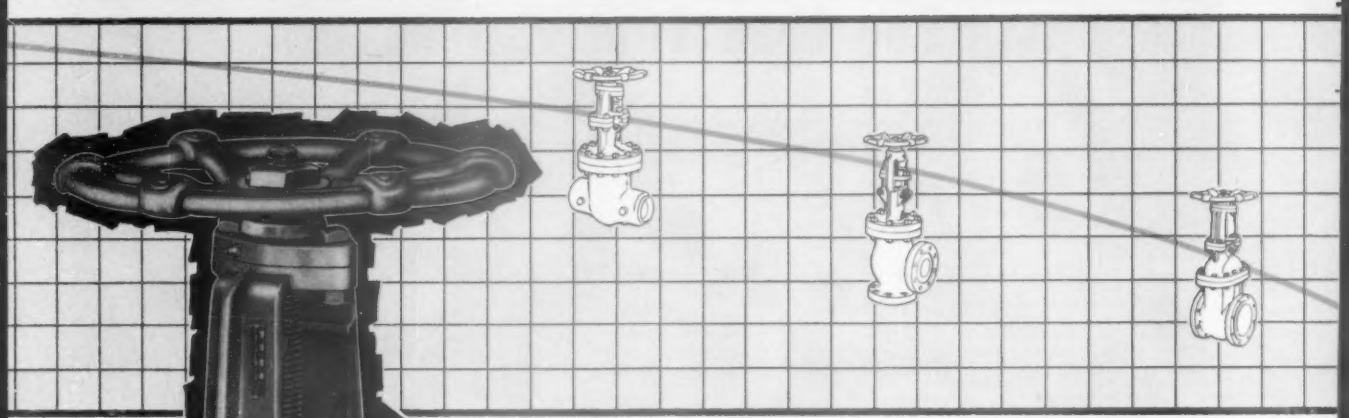
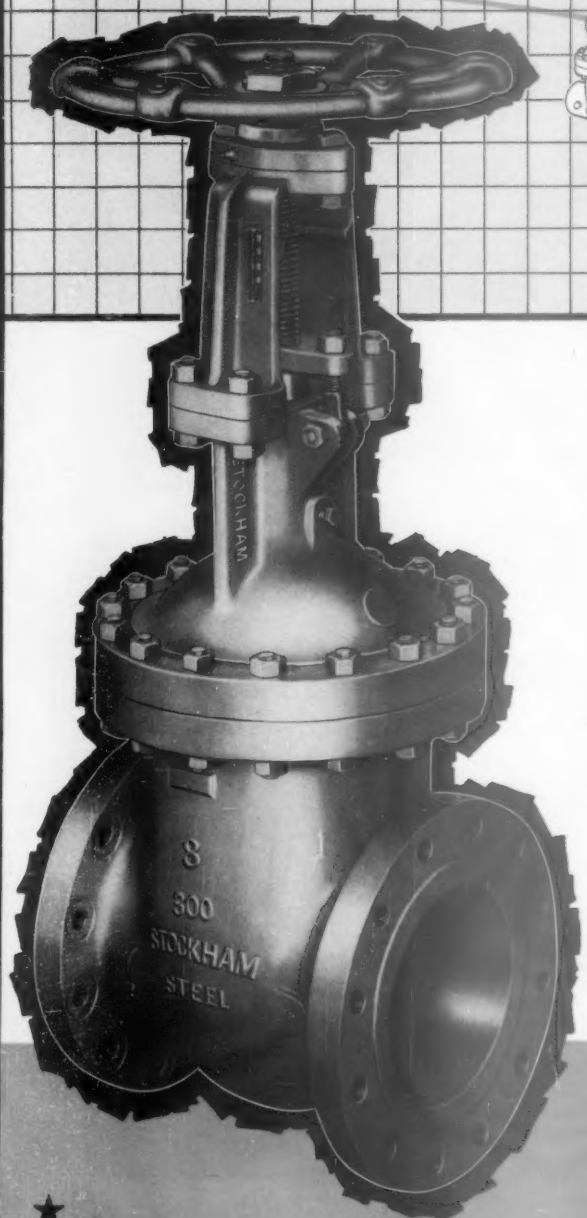
Engineered to Cut Valve Maintenance Costs

STOCKHAM STEEL GATE VALVES





GET THE design features you want and need to cut costs—get quality that lasts—in Stockham Steel Gate Valves.

Get full pipe size straight through port design. Seat rings are slotted; **no lugs protrude** in flow area.

These features make it the **easiest conventional type gate** valve to use in "pigging lines" and "hot tapping"—far more economical than conduit designs.

Other superior cost-cutting features include:

- ★ Disc and seat rings are precision ground for perfect seating
- ★ Disc guided throughout travel—eliminates wear
- ★ One piece yoke and cap—quick, easy maintenance
- ★ Non-corrosive copper nickel yoke bushing.

Precision quality control at every level of manufacture. Available in a wide variety of body and trim combinations. Gate, Globe, Angle and Swing Check Valves. 150, 300, and 600 Pound Pressure Classes.

★ NON-LUBRICATED PLUG VALVES...
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NAB Combustion Research Laboratory... Proving Ground for Burner Design Changes

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This modern Combustion Research Laboratory provides an excellent proving ground, not only for design changes in existing burner designs, but for finding better solutions to new problems. For example, many reported difficulties in burning certain types of gas and heavy fuel oils, including viscous residuums, have been solved successfully for industrial installations throughout the world.

As a result of this careful testing, you are assured of a complete line of quality products, each performance-tested before it reaches your installation. Bulletin 759 shows how the many facilities of this modern combustion research laboratory can help solve your particular industrial burner problem. Write for a copy. No obligation, of course.

Typical Combustion Tests Conducted Recently:

- For a large heater-furnace manufacturer for use in a major Caribbean petroleum refinery; vertical firing National Airoil Dual Stage oil burners of high capacity having a low atomizing steam consumption in a fresh water scarce area. Fuel is heavy, high temperature asphalt bottoms.
- For a large oil refining company and its fuel oil marketing organization; horizontally fully automatic rotary oil burners firing a mixture containing various proportions of otherwise unsaleable residues from propane deasphalting.
- Special vertical firing combination oil and gas burner units adapted to automatic combustion control for petroleum and chemical heaters-furnaces where maximum fuel economy is paramount along with a quick change-over of fuels.
- Vertical and horizontal firing oil burners using various grades of hydro carbon fuel gas under high pressure as the atomizing medium in place of, or alternately with, steam and compressed air.
- A series of steam atomizing #6 oil burning units for a wide turn down and employing uncommonly high oil pressure at the low capacity rates to improve the functioning of the automatic control, at the same time realizing a lower atomizing steam consumption throughout the entire wide range.
- Gun type mechanical atomizing oil burners with full automatic control on residual fuel oil or low pressure gas in a pressurized combustion chamber as applicable to direct fired air heaters and latest type pressurized boilers.
- Inspirating and non-inspirating gas burners with a varying percentage including up to 100% of hydrogen for vertical and horizontal firing in oil refineries and ammonia making plants.

FIELD REPORT

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OPERATOR: Mobil Oil Company

PUMPS: Two Aldrich Septuplex

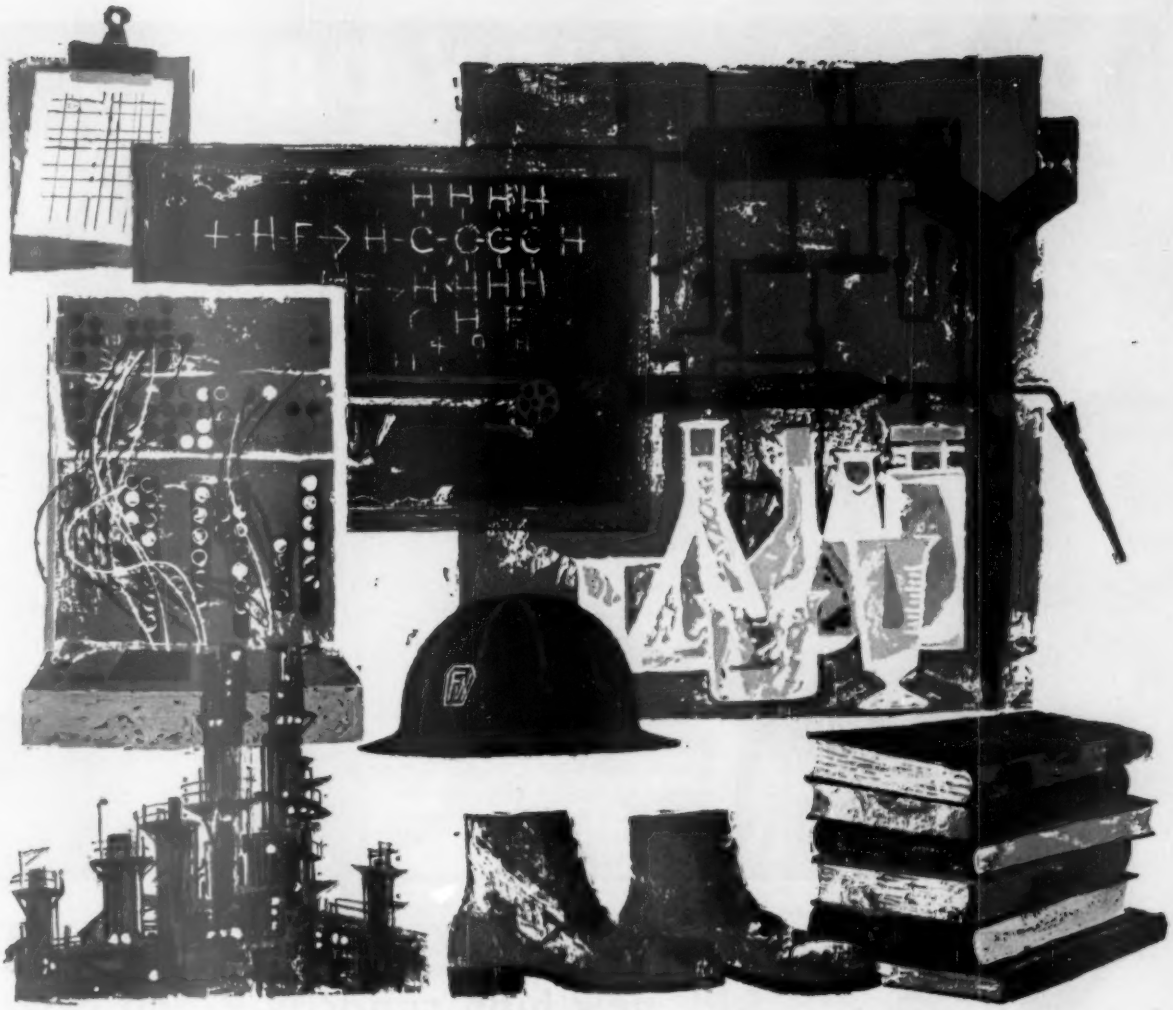
FLOODING STARTED: February, 1955

EXPERIENCE TO DATE:

Pumps continuously deliver brine to two formations — 90 gpm at 2,500 psi; 150 gpm at 1,000 psi. Customer reports: "Routine maintenance only. Aldrich pumps were selected because of previous dependable and economical service under high pressure operations."

Field parts stock available in Carmi, Ill.; Calgary; Casper, Wyoming; Charleston, W. Va.; Houston; Los Angeles; Odessa and Tulsa. For further information, write the ALDRICH PUMP COMPANY, 9 Gordon Street, Allentown, Pa.

the toughest pumping problems go to ALDRICH



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Two recent examples are plants delivered in good time and in good working order, operationally ready for quick write-off. They are a new ammonia plant producing in excess of 300 ton/day that exceeded rated capacity within 30 days of start-up; and a complete lube oil plant built in the Middle East which was in full production less than two years after award of the contract.

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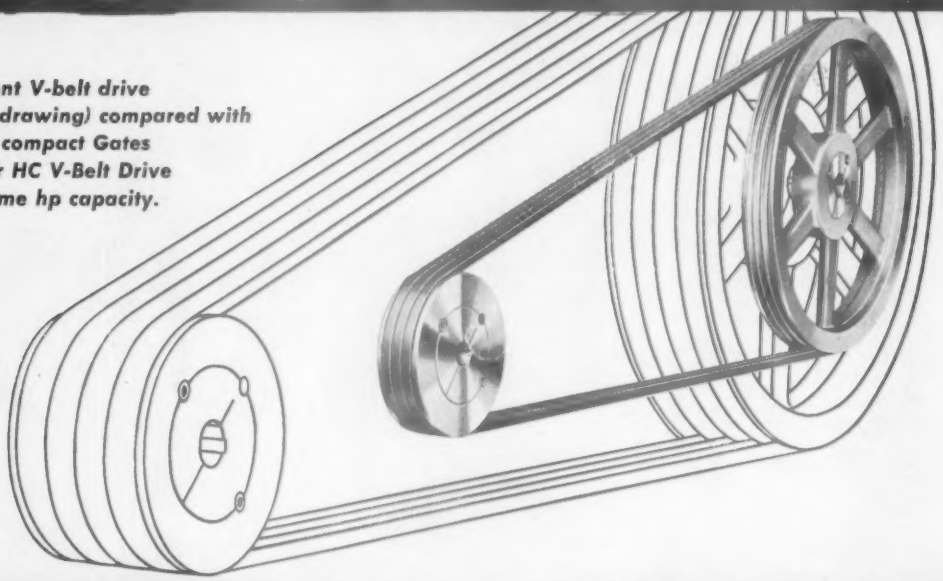
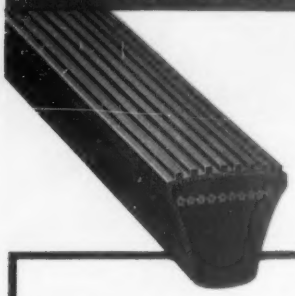
Designing NEW DRIVES?

Present V-belt drive (line drawing) compared with new, compact Gates Super HC V-Belt Drive of same hp capacity.



COMPARE: Left, typical drive with present V-belts. Right—drive of same hp capacity with Gates new Super HC V-Belts . . . uses fewer belts, smaller sheaves and shorter center distance.



For NEW drives on mud pumps Gates compact new Super HC V-Belt with the patented ribbed top cuts space required up to 50% and cost as much as 20%.

Gates

World's Largest Maker of V-Belts

Save up to 20%

with new high capacity V-belt drive

When you change the whole drive—on mud pump, pumping unit, or any other piece of petroleum equipment—remember: The cost of a Gates Super HC V-Belt is as much as 20% less than the cost of present V-belt drives of the same horsepower capacity.

A development of Specialized Research in the world's largest V-belt laboratories at Gates, the new Super HC V-Belt makes possible the most compact, lightest-weight, lowest-cost multiple V-belt drive you can put on any pump!

Cuts drive space as much as 50%

With Gates new Super HC V-Belt, sheave diameters and widths can be reduced 30% to 50%, center distances 20% and more. Bearing load is lightened and total space occupied by the drive may be cut as much as 50%.

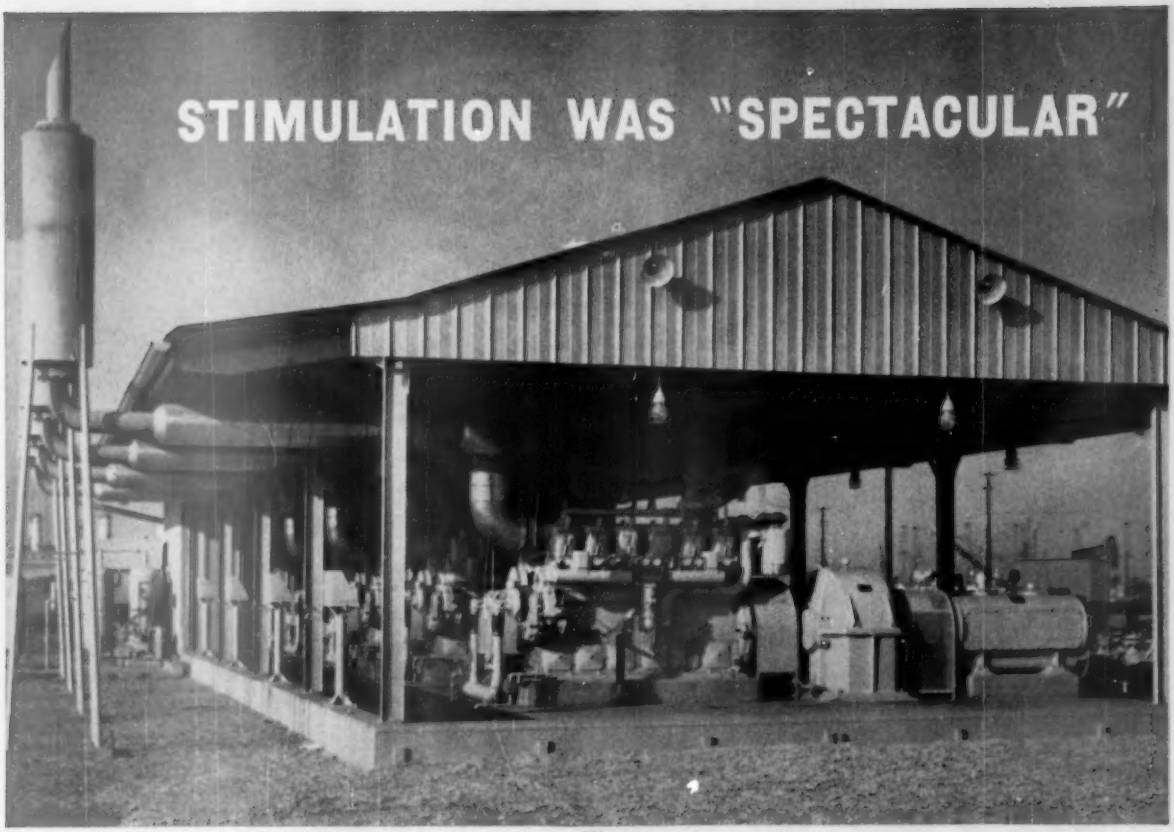
"The Modern Way to Design Multiple V-Belt Drives" is an informative handbook on the Super HC Drive, available from your nearby Gates Distributor listed in the Yellow Pages of your phone book.

The Gates Rubber Company, Denver, Colorado

Gates Rubber of Canada Ltd., Brantford, Ont.

TPA 439B

Gates Super HC V-Belt Drives



waterflooding at Long Beach with WAUKESHAS

The waterflood repressuring project—under Long Beach City property, in the Wilmington California Oil Field—is probably the country's largest. The Waukesha-Engine-powered Pier E station is the project's second water injection plant. Ten months after its activation, stimulation observed was "spectacular" as one expert put it.

Four Waukesha V-12 natural gas engines drive four Oilwell 558-P Quintuplex Plunger Pumps. Each pump delivers a volume of 20,400 bpd of salt water at a pressure of 1270 psi—at 175 rpm max., with 5-in. diam. plungers. The pumps can operate at 2000 psi, with 4-in. plungers, and deliver 11,150 bpd.

The four Waukeshas are Model VLROB natural gas engines, 12-cylinder, 8½ x 8½-inch bore and stroke, 5788 cu. in. displ. Engines are set to max. full load speed of 1020 rpm to give approx. pump speed of 175 rpm driving through speed reducers with 5.857:1 ratio.

These Waukesha Engines are equipped with S-69 Western Gear speed reducers; Ross 1204-CP Heat Exchangers; couplings—engine to reduction gears, 28-CB-525 Fawick—gears to pump, Fasts No. 6.

Send for Waukesha Bulletin 1656.

450

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They Say—

Back-to-back problem

Dear Sir:

I am starting my fourth year as a subscriber of your magazine. I find it an excellent source of up-to-date news of the oil and gas industry. One small detail of your format perturbs me, however.

As a geologist, I turn immediately to your Exploration Section in each issue. I clip and file the best of these articles. Occasionally, however, I have to sacrifice one of your articles because it appears back-to-back with another article.

May I suggest inserting a full-page ad between such articles? In this way, everything, if desired, could be saved. I would suggest the same for any exploration, pipelining, or drilling-production article.

Albert B. Dichos
Mobil Oil Co.
East Lansing, Mich.

(Editor's note: The Journal is aware of this problem and we do try to avoid printing back-to-back technical and exploration articles. But our production problems in spacing editorial material and ads sometimes make it impossible to avoid this situation.)

New unit in Beaumont

Dear Sir:

We enjoyed your well-illustrated article, "Process Obsolescence Is Costly to Refiners," (OGJ, Feb. 22, p. 78) in the report of Mobil Oil Co.'s continuing efforts to make more of their higher-quality products.

Concerning one of your captions on page 78, however, we wish to advise you that Pipe Stills 2, 3, and 4 at Beaumont are being dismantled as they were replaced by the 100,000-bbl. crude-distillation unit at Beaumont.

Beaumont, as you may recall, was the center of the petroleum boom when Spindletop blew in 59 years ago. Now Beaumont is becoming the hub of the Louisiana-Texas petrochemical activities.

P. H. Grady
Petroleum Chemicals Department
Mobil Oil Co.

A flexible policy

"If we view Canada as a country which must export goods and material;

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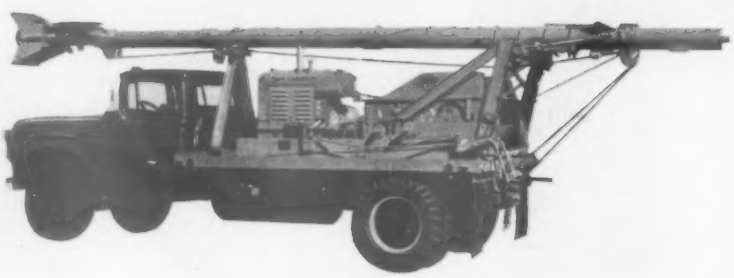
MODEL G-149 SKID WINCH FOR SERVICING TO 3000' OF 2" TUBING.

New field developed design is combined with high strength materials in a machine which can be transported over bad terrain with a small truck.

Sells at a price which makes it practical, for servicing marginal wells.

You don't pay extra for eight line speeds, vacuum actuated positive drum clutches, controls positioned at fingertips of operator, or sealed bearings at most points which eliminates lubricating them for their life, because all these features are standard.



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MODEL G-226 SKID WINCH FOR SERVICING TO 4000' OF 2½" TUBING.

Weighs hundreds of pounds less, but has the power, brakes and line pull flexibility through the standard 8 speeds to give top performance for swabbing, bailing or pulling rods and tubing on wells which formerly required a heavy machine on a large cumbersome truck for transportation.

Simplified operation requires much less effort by the operator and crew to do the job.

WHAT THE SIZE...OR WHERE IT IS

MODEL P-32 SKID WINCH FOR SERVICING TO 6000' OF 2½" TUBING. POWERED BY GASOLINE, L.P.G. OR DIESEL ENGINES UP TO 150 H.P.

Another in the complete range of machines built by Cooper to fit the job without compromise in performance or unnecessary equipment cost.

Complete selection of auxiliary equipment engineered for the machine.

Available are: Pipe masts, derricks, rotary drives, spudding equipment, catheads, catline guides, dividers, line guide shells.

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must import capital and people; and one in which the primary producer must absorb much of the cost of confederation, we have a foundation for our thinking.

"All levels of government should strive to encourage the development of resource industries by creating an atmosphere which is in the best interests of the investor and the consuming public.

"And, the low prices which are in the interest of the consuming public are identical with our ability to compete in export markets, whether it be raw or manufactured material.

"This would be my simple statement of national policy: Keep Canadian industry attractive to the investor. Keep it able to compete abroad and hence able to give the Canadian consumer the best value for his money.

"This is about as far as you can go in elaborating a national policy. When you go further, when you try to blueprint specifically, you lose all flexibility to meet rapidly changing conditions."

W. O. Twaits, executive vice president, Imperial Oil Ltd., in an article in the Imperial Oil Review, company magazine.

Imports loophole

"Last year we tried to limit the amount (of crude) going into Puerto Rico, but that hasn't been too effective.

"We think the purposes of the program will be served if all limitations were taken off imports of crude into Puerto Rico but a reasonable level set on imports of products into the United States.

"I think we are making progress with the Puerto Rican Government in that respect."

Capt. Matthew V. Carson, oil imports administrator, in a speech to Gulf Coast petroleum writers.

FPC's impossible task

"The Federal Power Commission has been given the impossible task of determining the cost of exploring for, finding, and producing gas separately and apart from the cost of exploring for, finding, and producing oil.

"There is no method of separating such costs except arbitrarily. Producer price cases pending before the FPC have been growing year after year and many millions of dollars are held in suspense by the producers subject to possible refund at a later date with interest, recently increased by the commission from 6 to 7%.

"The attempt to regulate gas producers by public utility methods is

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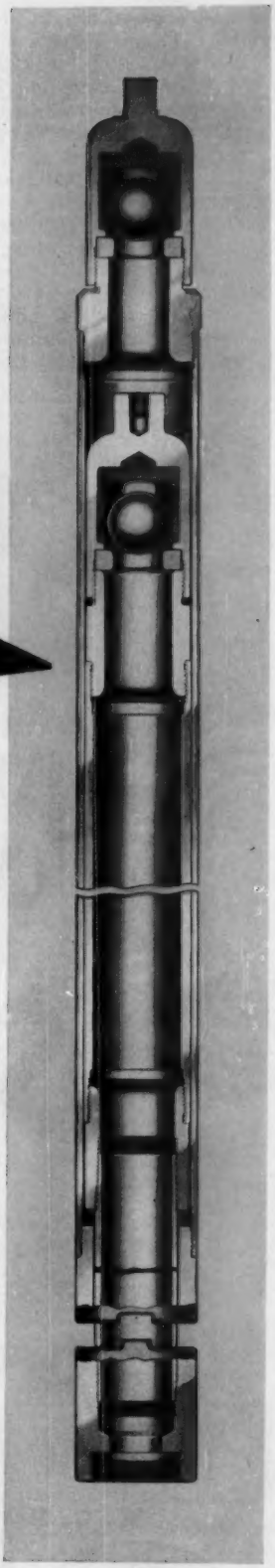
*WITH THIS PACIFIC INSERT ROD PLUNGER PUMP YOU GET VOLUME *plus*



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4 A pump ideally suited for pumping water supply wells in the range of 2000 to 3000 barrels of fluid per day for water flooding operations.

5 A pump equipped with Pacific Pacilite chrome plungers and the latest design rubber lined cages for long trouble-free operation.

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wasting countless man hours both in the FPC and in the oil and gas industry.

"Each and every one of us as individuals should make every effort to explain to the general public and to our representatives in Congress the chaotic situation that exists in the oil and gas industry as a result of the Phillips decision, and that it is necessary to the welfare of the oil and gas industry and to the economy of the country, and in the best interest of gas consumers, that gas producers be relieved from public utility regulation by the Federal Power Commission."

Albert Taylor, gas department manager, Amerada Petroleum Corp., in a speech to a regional Natural Gasoline Association of America meeting, Oklahoma City.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

APRIL

19-21 University of Oklahoma, College of Engineering, southwestern gas measurement short course, north campus, University of Oklahoma, Norman.

19-21 American Society of Lubrication Engineers, annual meeting and lubrication exhibit, Netherland Hilton Hotel, Cincinnati.

20 Chemical Institute of Canada, joint meeting, Quebec rubber and plastics group and Montreal section, Queen's Hotel, Montreal.

20-22 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Gladstone, Henning, and Townsend hotels, Casper, Wyo.

20-22 National Petroleum Association, semiannual meeting, Hotel Cleveland, Cleveland.

21-22 Oklahoma State University, technical conference on heat transfer, Stillwater, Okla.

21-22 Texas Technological College, seventh annual West Texas oil lifting short course, Lubbock, Tex.

24-26 Independent Petroleum Association of America, midyear meeting, Denver Hilton Hotel, Denver.

25 University of Oklahoma, fifth annual conference on automatic control in the petroleum and chemical industries, Norman, Okla.

25-26 American Society of Mechanical Engineers, maintenance and plant engineering conference, Chase-Park Plaza Hotel, St. Louis.

25-27 Southern Gas Association, convention, Buccaneer and Galvez hotels, Galveston.

25-28 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

25-29 American Welding Society, annual meeting and welding exposition, Los Angeles.

27-29 Natural Gasoline Association of America, annual convention, Rice Hotel, Houston.

28-29 American Petroleum Institute, Division of Transportation, pipeline conference, Mayo Hotel, Tulsa.

28-29 Pacific Coast Gas Association, distribution conference, Benson Hotel, Portland.

28-May 1 Mississippi Geological Society and Society of Economic Paleontologists and Mineralogists, Gulf Coast section, field trip to coastal Mississippi and southwestern Alabama.

29-30 Mississippi Academy of Sciences, Inc., Millsaps College, Jackson, Miss.

30 Geological Society of America, Rocky Mountain section, Black Hills area field trip.

MAY

1-3 Texas Independent Producers and Royalty Owners Association, fourteenth annual membership meeting, Holiday Inn, Carlton and Blackstone Hotels, Tyler, Tex.

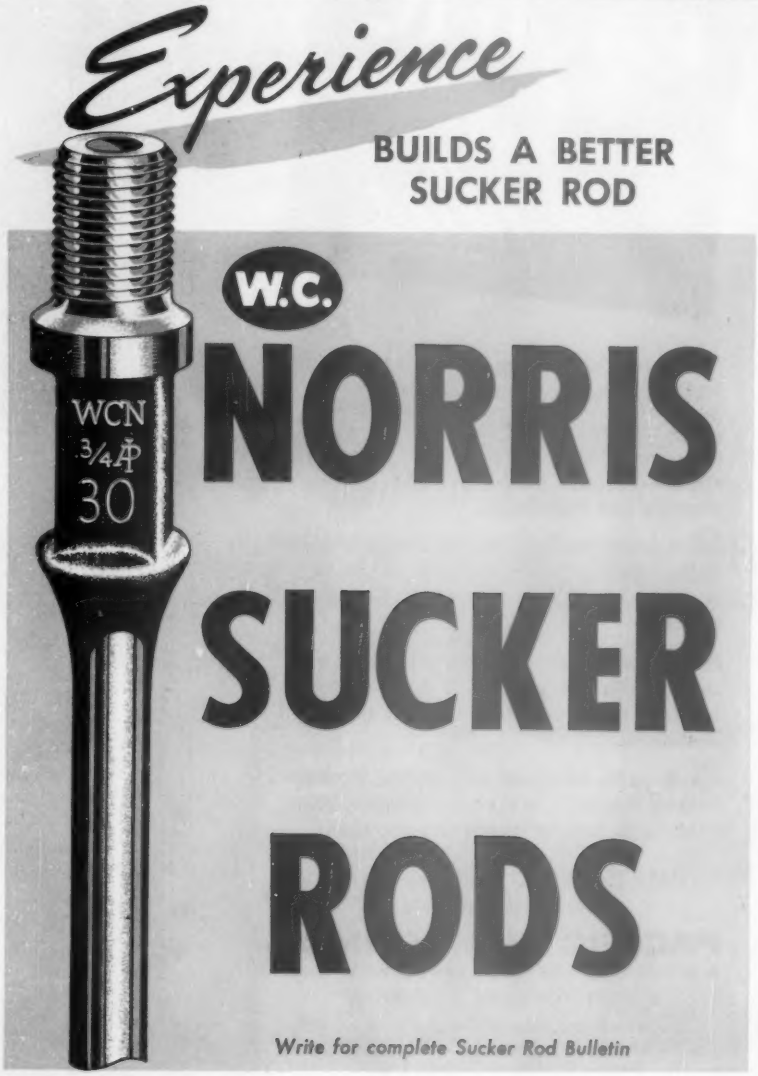
1-4 American Petroleum Institute, Division of Transportation, tanker conference, Seaview Country Club, Absecon, N. J.

2-3 Society of Petroleum Engineers of AIME, North Texas section, fourth biennial secondary recovery symposium, Wichita Falls, Tex.

4-6 Society of Petroleum Engineers of AIME, Rocky Mountain sections, and Canadian Institute of Mining and Metallurgy, petroleum division, joint meeting, Palliser Hotel, Calgary.

9-12 American Petroleum Institute, Division of Refining, midyear meeting, Statler and Sheraton-Cadillac hotels, Detroit.

9-12 Instrument Society of America, in-



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Q-BROXIN mud treatment controls flow properties in the presence of calcium and chloride contamination and such muds are stable at high temperatures. Inhibited muds are easy to control with Q-BROXIN.

A Baroid mud program *is planned* to give *you* drilling success and *save your drilling dollars.*

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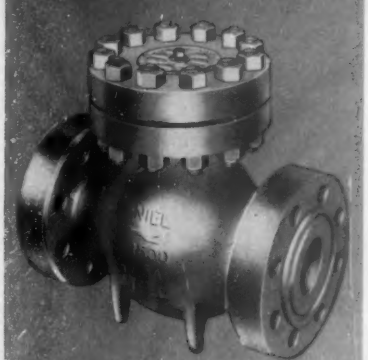

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strument-automation conference and exhibit, Civic Auditorium and Brooks Hall, San Francisco.

9-13 American Gas Association, distribution and transmission meeting, Jung and Roosevelt hotels, New Orleans.

11-12 University of Kansas, gas conditioning institute, National Guard Armory, Liberal, Kans.

11-14 Fluid Controls Institute, spring meeting, The Greenbrier, White Sulphur Springs, W. Va.

12-13 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

12-14 Kansas Independent Oil and Gas Association, annual meeting, Lassen Hotel, Wichita.

13-14 Southern Methodist University, School of Engineering, advanced technology seminar on heat transfer in electronics and direct conversion of heat to electricity, Dallas.

16-17 International Society of Professional Well Log Analysts, first annual meeting, Tulsa Hotel, Tulsa.

18-20 American Petroleum Institute, Division of Marketing, midyear meeting, Statler-Hilton Hotel, Cleveland.

22 Pennsylvania State University, short course in reservoir engineering, University Park, Pa. Term ends June 10.

22-26 Air Pollution Control Association, annual meeting, Netherland-Hilton Hotel, Cincinnati.

23-24 American Gas Association, production meeting, Roosevelt Hotel, New York City.

23-26 American Society of Mechanical Engineers, oil and gas power conference and exhibit, Muehlebach Hotel, Kansas City.

24-25 Western Petroleum Refiners Association, computer conference, Ben Milam Hotel, Houston.

24-26 American Right of Way Association, annual seminar, Shoreham Hotel, Washington.

25-27 Pacific Coast Gas Association, accident prevention and transmission conference, Hotel Utah, Salt Lake City.

25-28 American Association of Petroleum Geologists, western Canada regional meeting, Banff Springs Hotel, Banff, Alta.

26-27 Natural Gas and Petroleum Association of Canada, meeting, Niagara Falls, Ont.

JUNE

1-3 Texas College of Arts and Industries, fifteenth annual short course on gas technology, sponsored by Southern Gas Association, Kingsville, Tex.

1-3 West Virginia University, fifth annual Appalachian underground corrosion short course, Morgantown, W. Va.

2 Pennsylvania Grade Crude Oil Association, annual meeting, Pennhills Club, Bradford, Pa.

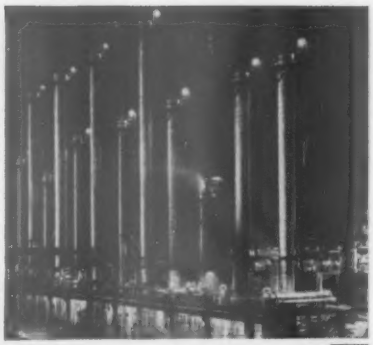
2-3 Kentucky Oil and Gas Association, annual meeting, Phoenix Hotel, Lexington.

5-9 American Society of Mechanical Engineers, summer annual meeting, Dallas.

5-10 Society of Automotive Engineers, summer meeting, Edgewater Beach Hotel, Chicago.

9-11 Manufacturing Chemists' Association, annual meeting, The Greenbrier, White Sulphur Springs, W. Va.

13-15 American Association of Cost Engineers, annual meeting, Rice Hotel, Houston.



Distillation Units at the Shell Chemical Plant, Stanlow, Cheshire. Photograph by courtesy of Shell Refining Co. Ltd.

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Representing so much in capital outlay, this Shell Distillation plant must be protected against the sharp teeth of corrosion—and what better for the purpose than Episeal Aluminium Paint.

Episeal, one of the comprehensive range of International paints for the oil industry, is an air-drying Epoxide paint. Tough as nails, long-lasting, resistant to dirt and corrosion, it gives ideal protection to storage tanks, rail tank cars, pipelines and other structural steelwork.

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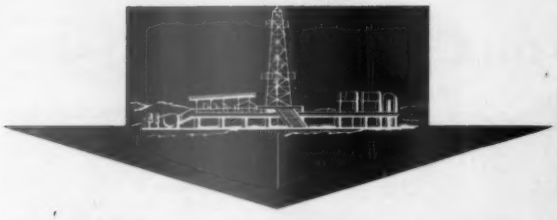

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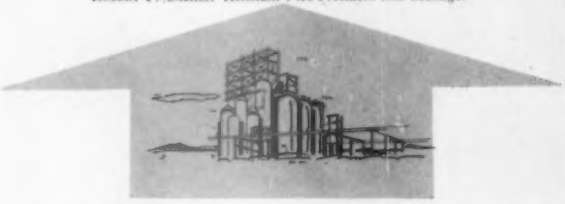

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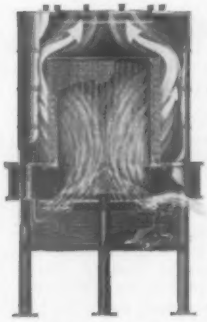

The Air-Maze Type LPD (Low Pressure Drop) oil bath air filter makes possible low static pressure loss operation without any outside energy or moving parts whatever. As a result, it offers particular benefits in cleaning of intake air on turbocharged stationary engines, since pressure losses of silencers, piping, elbows and air cleaners are additive.

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- All are equipped to make any repairs.
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Drawer 591 Okmulgee, Oklahoma

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Illustrated: 400 pound pressurized dry chemical

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- Simple, fast operation lets you get the jump on any fire. The units give you shut-off valve control at the nozzle too.
- Special Kidde universal nozzle gives long-range discharge pattern without any turbulence. 40′ discharge range.
- Both 200 and 400 pound units can be installed either free-standing or wall-mounted. 50′ or 100′ of hose.
- Underwriters' Laboratories-approved.

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13-15	Chemical Institute of Canada, annual conference and exhibition, Chateau Laurier, Ottawa.
13-15	Interstate Oil Compact Commission, midyear meeting, Statler Hilton Hotel, Detroit.
15-16	Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Hotel Lassen, Wichita.
19-22	American Institute of Chemical Engineers, Instituto Mexicano de Ingenieros Quimicos, joint meeting, Hotel Del Prado, Mexico City.
22-25	Canadian Gas Association, annual meeting, Manoir Richelieu, Murray Bay, Quebec.
22-25	American Association of Petroleum Landmen, national convention, Ambassador Hotel, Los Angeles.
25-29	Petroleum Equipment Suppliers Association, annual meeting, Banff Springs Hotel, Banff, Alta.
25-July 5	First International Congress for Automatic Control, Moscow, U.S.S.R.
26-28	North American Gasoline Tax Conference, annual meeting, southern region, Eden Roc Hotel, Miami Beach.
26-July 1	American Society for Testing Materials, annual meeting and exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J.
27-28	Michigan Gas Association, Mackinac Island, Mich.

JULY

28-30	American Petroleum Institute, Division of Production, Eastern district meeting, The Greenbrier, White Sulphur Springs, W. Va.

AUGUST

3-5	Wyoming Geological Association, field trip to Snyder basin and Wind River Mountains, Casper.
14-19	National Congress of Petroleum Retailers, Inc., annual session, Shamrock-Hilton Hotel, Houston.
15-17	American Society of Mechanical Engineers, American Institute of Chemical Engineers, heat transfer conference and exhibit, Statler Hilton Hotel, Buffalo, N. Y.
15-26	Sacramento State College, summer institute on nondestructive testing, Sacramento, Calif.
22-26	Gordon Research Conference, catalysis, Colby Junior College, New London, N. H.
29-31	Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

SEPTEMBER

6-7	Chemical Institute of Canada, organic chemistry division conference, Edmonton.
7-9	American Society of Mechanical Engineers, joint automatic control conference, Massachusetts Institute of Technology, Cambridge, Mass.
8-9	National Research Council, Chemical Institute of Canada, tenth Canadian high polymer forum, Alpine Inn, Montreal.
8-10	Chemical Institute of Canada, western regional conference, Regina.
11-16	American Chemical Society, national meeting, New York City.
14-15	Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.
14-16	National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.
15	Natural Gasoline Association of America, Rocky Mountain regional meeting, Palliser Hotel, Calgary.

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WEEDS ARE A HAZARD YOU CAN'T AFFORD!

Avoid danger . . . spray them away with GARLON

Weeds and grasses have taken over this tank farm, hiding pipelines and valves, rusting fences, creating a fire hazard. Under old-fashioned methods, this would have meant weeks of steady work for an extra crew at prohibitive labor costs.

The modern, low-cost method—spray them away with Garlon*. And since Garlon can be applied anytime weeds are growing actively, you can do it at your convenience and spread your maintenance dollar over a longer period.

Garlon is easy to use, too. Simply add the required amount of water, mix, and you're ready to spray. Your own crew can do the job, or a professional contractor will do it for you. Re-treating on a spot basis is easy and inexpensive too.

It all adds up to lower-cost control of trouble areas like storage areas, pipelines, fences, sidings, drainage ditches, parking lots. And the cost gets progressively lower! Once you start a program of chemical vegetation control, you'll find fewer sprayings are required each year to knock out weeds and grasses.

*TRADEMARK

Hand-cutting costs stay constant from year to year

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For more information on modern chemical vegetation control write: THE DOW CHEMICAL COMPANY, Agricultural Chemicals Sales Dept. 204DC1-25, Midland, Michigan.

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"...pacing the pipeline construction industry
for more than a quarter century"

price tower H·C·PRICE·CO PIPELINE CONSTRUCTORS bartlesville, oklahoma

50 years ago

April 20, 1910

The newly formed Petroleum Publishing Co. acquires the stock, fixtures, and good will of Oil Investors Journal, published by Holland S. Reavis at Beaumont, Tex. The new owner announces there will be no immediate change in policy except to extend news coverage and publish weekly instead of biweekly. Both H. L. Wood, president; and W. D. O'Neill, business manager, of the new company, will be active in all phases of publishing the journal. (Name changed immediately to The Oil and Gas Journal).

Refining & Producing Oil Co., a newly organized $21,000,000 corporation, buys the 20,000-bbl. plant of California Refineries, Ltd., at Oilport, near Port Artford, Calif. In addition, it has acquired from Alliance Oil Co. 16,000 acres of proved and prospective oil land at Santa Maria, and 1,000 acres at North Midway and McKittrick. Among officers of the new corporation are J. I. Lamprecht, president, and Theodore N. Barnsdall, vice president.

25 years ago

April 18, 1935

Texas clamps new controls on tank-truck movements to plug one of the last loopholes in curbing illegal oil production in the state. Stiff penalties imposed on shippers and haulers moving oil or refined products without state-issued tenders.

New Port Lavaca field in northern Calhoun County becomes center of interest on Texas Gulf Coast following completion by Steinberger Petroleum Corp. of its 1 Schofner as field's first oil well. Flow of 574 bbl. of oil daily is gaged through ¼-in. choke from Frio pay at 6,238 ft. Extensive development program gets under way.

10 years ago

April 20, 1950

President Truman vetoes Kerr natural-gas bill against Federal Power Commission's jurisdiction over field production and prices of natural gas for interstate movement. Congress sees no chance of overriding veto.

Phillips Petroleum Co. acquires major portion of Sunray Oil Corp.'s stock in American Independent Oil Co., owner of 50% of the Kuwait-Saudi Arabian Neutral Zone concession. Phillips already was the largest single owner of American Independent.

Standard Oil Co. (New Jersey) halts oil-exploration activities in Egypt. Laws hampering foreign capital blamed. Standard Oil Co. of Egypt, Jersey's local exploration subsidiary, liquidates physical assets.

JOURNALLY SPEAKING

A Few Stories

FELLOW WE KNOW in East Texas tells a story about a golfer who sliced his drive onto a busy highway, knocking the ball through the windshield of a car and causing a head-on collision with another car.

Both cars were wrecked, one person was killed, and two badly injured.

When the police, wreckers, and ambulances finally got the mess cleaned up a patrolman went over to the golfer, who had been standing on the tee watching the whole proceedings, and said:

"You see what you did. What do you think you ought to do about it?"

"It worries me," said the golfer. "I've been standing here thinking about it and I've finally decided that what I ought to do is to hold my left thumb a little farther down on the grip."

Somehow that story seems to illustrate some things that are going on in the oil business. Certain operators seem so intent on their own game that they have no concern for the effect their bad shots may have on others.

Like, for instance, when a refiner swings too hard at the incremental barrel, goes way off the fairway of his normal markets, and slices disastrously into somebody else who is just going along minding his own business. He may worry more about losing that stroke than about the wreck he caused on the public highway.

The story might also be applicable to situations other than excess refinery runs and the dumping of distress products outside of usual market channels. Some producers, crude purchasers, importers, marketers, and others may be indifferent to the effects their "slices" have on innocent bystanders.

Which reminds us of another story told by an oil man who has been going around the oil patch trying to convince people that they ought to mend their ways by getting hep to current conditions and paying more attention to supply and demand.

It seems a colored preacher broke up a crap game in back of the church just before Sunday School and gave the errant youngsters a severe lecture. Then he asked how many wanted to go to heaven. All raised their hands except one.

"What!" asked the preacher. "Don't you want to go to heaven when you die?"

"When I die, sure," said the kid. "I thought you were getting up a crowd to go now."

The moral, as our friend applies it to the oil industry, is that some people want to have a fling at sowing some wild business oats before they bring themselves to doing what they know they ought to do eventually.

For example, practically anybody in business knows that he will never get to financial heaven by selling his wares at less than they cost. Yet quite a few merchandisers of petroleum products seem willing to postpone that trip while they indulge in the earthly joys of a commercial crap game in which they try to get the dice away from their competitors by underselling them at any cost.

The justification for such actions is the old reliable salesman's adage that you can't make a profit without sales.

That is true enough, but too many people forget to look at the other side of the coin which says that you can make sales without a profit.

Making a profit on sales would seem to be more important than just making sales. Unless, of course, you are in business just for the fun of selling.

Like the story of the newsboy who was asked how much he paid for his papers.

"Fi' cents."

"What do you sell them for?"

"Fi' cents."

"You can't make any money that way."

"No, but I get a chance to holler, don't I?"

A chance to holler seems to be about all some people are gettting out of the oil business these days.

—Henry D. Ralph.

The weld you spread with a knife

Do you still weld shoes and collars to casing?

Bakerlok makes a stronger (and safer) joint -and at lower cost

Operators tell us that once you've used Bakerlok to lock shoes and collars to casing, you don't want to work without it.

Bakerlok makes a stronger casing joint than tack welding, and does it for a lot less money.

And note this: Bakerlok makes a safer joint, too. It doesn't weaken your casing as arc-welding sometimes does. Most operators are using Bakerlok on the strength of this point alone.

These are not mere claims. Thousands of successful field runs prove Bakerlok's success beyond any doubt whatever.

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Bakerlok kit contains 8 ounce can of compound, activator, and putty knife. Kit is available at supply stores all across the country.

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Why Baker Recommends Bakerlok

Bakerlok was developed to help operators get the best possible service out of Baker casing shoes and collars. Our interest is natural, since Baker is the world's largest manufacturer of shoes and collars. In Baker's opinion, arc-welding is not a satisfactory way to lock shoes and collars to casing. Bakerlok does everything welding does, does it faster, and does it without the harmful weakening effect of arc heat on high-grade steel casing.

Apply Bakerlok with putty knife to first ⅔ of pin threads only. 8 ounce can locks six 5½" joints.

Louisiana's cut paves the way for brighter prospects

IT IS BEGINNING to look as though the producing end of the oil industry is making a serious effort to hold crude output more nearly in line with actual demand this season.

Best news of the week was the announcement that Louisiana, at long last, will reduce allowables during May and June "in view of the nationwide situation".

Coming on top of curtailments by several other states, plus purchaser proration by a number of buyers, this should go far toward preventing an oversupply of crude which so frequently builds up during this period of the lowest demand of the year.

THESE ACTIONS ARE NONE TOO SOON. Crude stocks have been rising rather sharply and are now higher than they ought to be, everything considered. They appeared to be headed for a repeat of last year's performance when they rose to an unwieldy peak in June and forced drastic proration during the summer months.

Louisiana, like Texas, Oklahoma, and other states, complains that it has not been getting its "fair share" of the national market when measured by reserves, historical position, or some other factor.

But such debate seems academic when total supply is so great that the whole industry is in trouble, prices keep crumbling, and purchasers resort to their own prorating. If supply can't be balanced to demand with complete equity, it must be done by whatever means are available.

The most acute current trouble of the oil industry is that its markets are undermined by excessive products, particularly gasoline. Experience shows that refiners can't be trusted to drop their runs in line with seasonal declines in demand so long as producers keep shoving crude at them.

So the balancing mechanism must be adjustments in crude supply, and this requires responsible prorating by all big producing states.

NEARLY EVERY SPRING crude output and refinery runs fail to decline in proportion to the seasonal demand drop. Then the whole industry winds up in a badly overstocked position at midsummer.

An article on page 75 of this issue explains this clearly. It also suggests operating schedules for the next few months that would put the industry back in a desirable supply-demand position.

It is good to see Louisiana line up with her sister states in shouldering some of the burden of correcting the imbalance. Its action should encourage others to do a little more than they have done.

If everybody does a little, it won't take much more of a cut to clear the way for reasonably good summer and fall prospects. At the moment it looks as though real progress is being made toward that goal.

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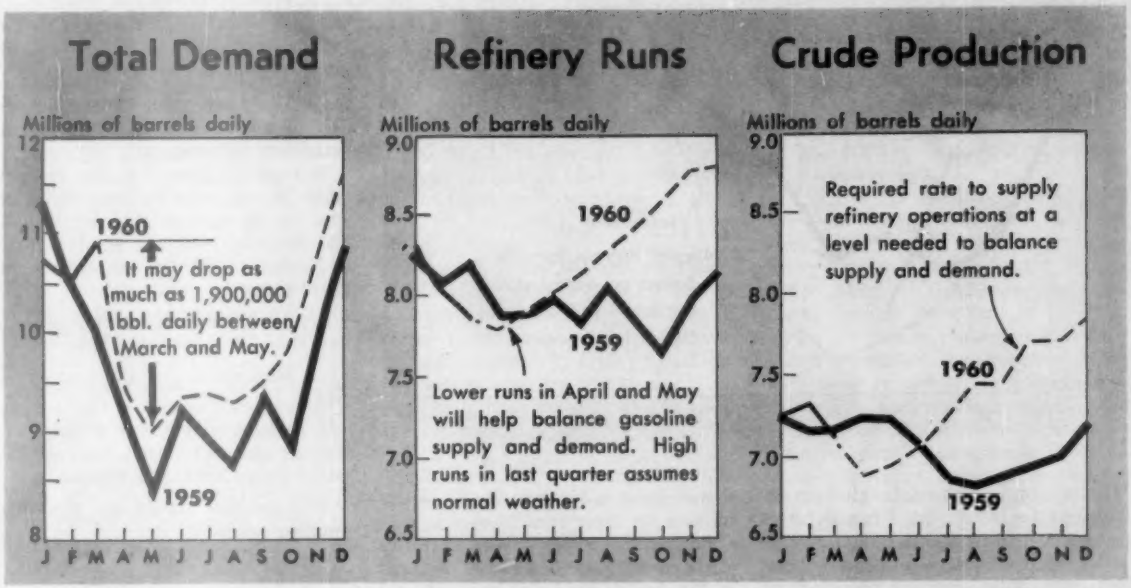


Restraint Now Means a Good 1960

• The figures show a promising year for oil men. But whether the extra business is handled on a sloppy market or at good prices will depend on how hard the industry tries to match supply to demand in the next few weeks.

DECISIONS being made this month by individual refiners, crude buyers, and officials of prorated states will set the economic course of the oil industry for the rest of 1960.

Several benchmarks are now apparent for the rest of the year to guide these decisions:

... **Total demand** this spring will do a sharper than normal nosedive, probably setting an all-time record.

... **Refiners** should throttle down runs in the second quarter, averaging 7,800,000 bbl. daily in April and 7,900,000 in May.

... **Crude production** in April should average less than 7,000,000 bbl. daily with only a small increase in May.

Then with the usual upturn in gasoline demand starting with vacation season on Memorial Day, such a cutback program would mean that refinery runs and production could take healthy increases the last half of the year.

If the industry doesn't retrench, it will run into a sloppy gasoline market at the start of the motoring season. Remember 1959? This again could haunt refiners throughout the summer. Crude overproduction, likewise, would only cause a heavy inventory and add to current price troubles.

Demand outlook . . . Reason for the expected abnormal drop in total demand this spring may be found in the weather.

This winter, the weather was very mild in January. Real winter did not get started until about the middle of February, and low temperatures continued through March.

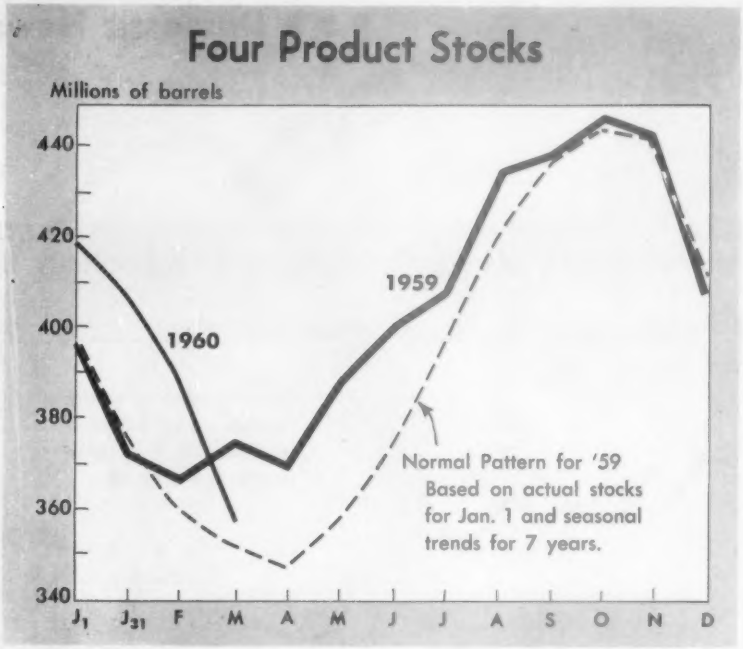
The cold March weather boosted March demand far above normal—it actually was sharply above January demand.

Another factor in the slack January-February fuel demand is the normal buying practices of distributors. They tend to let their distillate stocks run low in February so they aren't caught with heavy supplies at the end of the heating season. In a normal year, most buying after the middle of February is on a day-to-day basis.

So with stocks low in jobbers' tanks this year when the cold weather hit about mid-February, consumer demand produced a mad scramble for supplies. This big movement to secondary suppliers caused an unusual draft on primary stocks.

There's normally a sharp unbroken drop in demand from January to May, with the sharpest part from March to May. Last year part of the big drop was due to an unusual dip in demand for the month of May. This year the big drop will be due to abnormally high demands in March.

If demand happens to drop off in May this year as much as it did in 1959, the March-May reduction would set an all-time record. Even



with a normal seasonal reduction in demand for May, the 2-month drop is expected to be about 1,900,000 bbl. daily. That volume would equal about half the total gasoline demand in March.

Facing this big drop in demand, refiners have only one course of action: Reduce runs for April and May enough to prevent burdensome accumulation of refined stocks—particularly gasoline at the start of the motoring season.

The summer season . . . The big question is how much to cut and where to set refinery operations the rest of the year.

It will be unwise this year to set operations by a schedule based on last summer's demand. Monthly comparisons of demand expected this summer with corresponding months last summer will show some unusual shifts.

An abnormal demand pattern developed last summer with unseasonal dips in July and August. Then the steel strike adversely influenced demand for the last half of the year. Closing the steel plants reduced demand for residual, gasoline, diesel fuels, and even heating fuel.

A different outlook should prevail this year. A slight reduction may show up in August based on a probable easing in demand for gasoline that month. After that, demand should reach 9,500,000 bbl. daily in September and keep rising to the end of the year at levels sharply above 1959.

The gasoline inventory situation should have a big bearing on where refiners set their runs.

Product inventories were excessive at the start of 1960, and low demand in the first 6 weeks of the year did little to clean up distillate inventories. However, the February-March cold weather solved the stock problem for middle distillates.

The same cold weather tended to limit consumption of gasoline. Refinery runs for January 1960 jumped 50,000 bbl. daily over the year before, and at the same time total demand eased off 640,000 bbl. daily. Refiners did cut runs in February and March, but still gasoline stocks remained at an all-time peak at the end of March.

Since gasoline stocks are higher than needed to assure a supply for summer driving, refiners should hold runs at a low level at least through April. If runs can be reduced to an average of 7,800,000 bbl. daily for April and 7,900,000 bbl. daily in May, there is a good chance that summer gasoline demand will clean up the gasoline stock surplus.

This would mean stepped-up runs in the last half to cover anticipated increases in demand.

The crude outlook . . . Production of crude for the remaining months of the year should be adjusted to seasonal variations in demand with proper allowance for changes in product stocks.

The experience of last year should be avoided. The peak production rate for 1959 came in the first half of the year. Normally, December should be the record month for crude production. It generally is the month of highest demand; and unless product stocks are very high, it should be the peak month for refinery runs.

The deep production cut that started in July last year resulted from two factors:

. . . Product inventories were much too high at the end of March. A cut in refinery runs was not enough to prevent an early-summer surplus.

. . . The steel strike during the last half of the year restricted growth of petroleum demand.

If total production in the country could be scheduled for the rest of the year on the basis of meeting demand and building adequate inventory for early-winter cold, the program would go like this:

. . . April production would average less than 7,000,000 bbl. daily.

. . . May would get only a small increase.

. . . June would reflect a pickup in summer demand with crude production topping 7,000,000 bbl. daily.

. . . Last half would see continual monthly gains if demand kept up. The year would close out with 7,750,000 bbl. daily in December.

Word of caution . . . It may be dangerous this year to rely on comparisons of current four-product stocks with those of the same period last year.

Stocks in 1959 were very high during the spring and summer months. Current stocks very well could show a loss and still be too high.

The normal product inventory pattern for 1959 based on trends over the last 7 years starts in January at 398,000,000 bbl. and drops to a low of 348,000,000 bbl. in late April. The actual stock level in 1959 on that date was 371,000,000 bbl. The gap was narrowed gradually through the rest of the year.

This spread between actual and normal stock levels in 1959, however, was an important factor in the development of soft product markets.

So far this year, four-product stocks have taken a sharp drop from their exceedingly high position in January of 418,200,000 bbl. They have dropped to 357,400,000 bbl. compared with last year's level of 375,200,000 bbl. But they still are higher than the normal 1959 level of 350,800,000 bbl.

Product stocks have been reduced, but much of the drop has been in fuels. Now, gasoline stocks need the attention of refiners throughout April and May.

First Quintuple Completion Is made

• Sinclair has a five-in-one well in Louisiana offshore waters. Equipment similar to that used for quadruples, except everything comes in fives.

OFFICIAL announcement of the world's first quintuple completion is expected this week.

The first five-stringer belongs to Sinclair Oil & Gas Co. and is drilled from a platform in Louisiana offshore waters. The well tested productive in all five zones. It presently is shut in awaiting installation of storage facilities or a pipeline to shore.

It is Sinclair's OCS-0439, located offshore from St. Mary Parish in Block 190. The well, drilled to 7,981 ft., is in the eastern portion of the Eugene Island Block 188 field discovered in October 1956 by Shell Oil Co. Phillips Petroleum Co. has production in the field in Block 191.

Here's a rundown on tests of Sinclair's well:

. . . **Zone 7.** On 12-hour test, flowed 2,100 M.c.f. of gas and 5 bbl. of 44.6°-gravity oil through 12/64-in. choke from perforations at 6,156-66 ft. GOR was 4,200:1 and tubing pressure was 2,525 psi.

. . . **Zone 4.** On 18-hour test, flowed 2,150 M.c.f. of gas and 5.7 bbl. of 44.6°-gravity oil through 12/64-in. choke from perforations at 6,832-38 ft. Gas liquid ratio was 377,368:1 and tubing pressure 2,700 psi.

. . . **Zone 5.** On 22-hour test, flowed 2,000 M.c.f. of gas and 5.3 bbl. of 44°-gravity oil through 12/64-in. choke from perforations at 6,359-65 ft. GLR, 377,358:1, and tubing pressure, 2,450 psi.

. . . **Zone 1.** On 24-hour test, flowed 1,850 M.c.f. of gas and 3.5 bbl. of 44°-gravity oil through 12/64-in. choke from perforations at 7,095-99 ft. and 7,103-07 ft. GLR, 528,000:1, and tubing pressure, 2,500 psi.

Sinclair has not disclosed information on testing of the fifth sand.

Fishing job . . . Announcement of the five-in-one well has been delayed more than a month.

While one of the zones was being brought into production a swab line was dropped into one of the strings. Usual fishing methods failed.

Though some thought it almost impossible, the affected tubing string was pulled and rerun without filling or pulling the other four strings. The tripped string was pulled from a point above the uppermost packer at 6,103 ft. and stabbed back into its connection without incident.

The five 2⅜-in. strings are installed in 10-in. casing. After the well had been performed in all zones, a wireline packer was set above the bottom sand. Then, all five strings and the upper packers were run in together. When all were in place and the chrismas tree installed, the packers were set by pressuring each string from the surface. Each string was brought in by swabbing through the tree.

In the past 3 years, some 10 or 12 quadruple-string completions have been made. Most are offshore.

Equipment used in Sinclair's quintuple is similar to that used in the previously made quadruples. The major difference is that everything comes in fives.

Famous Phillips Case May Finally Be Settled

• The company says FPC approval of rates set in contracts with pipeline companies would forestall further legal challenges by intervenors.

PHILLIPS Petroleum Co. has suggested to the Federal Power Commission a method for settling the 12-year-old Phillips case and possibly avoiding additional court battles on the issue.

Phillips proposes that the FPC approve the rates called for in its contracts with the pipeline companies.

This approach, Phillips said, would help avoid further challenges by intervenors in the case because the intervenors had agreed on the contract prices when the contracts were made. Thus, Phillips reasoned, they would have little basis for contesting those prices.

Phillips warned that any method used by the FPC to determine individual rates to meet a specific cost of service would undoubtedly be assailed in court by practically all parties and further prolong a final decision.

Phillips said the plan it suggests—acceptance of contract rates—would mean lower revenues for the company than it would be entitled to under a utility-type cost of service. But, it said, it is willing to accept this rather than get involved in the legal tangle it foresees if the utility-type approach is used.

Phillips estimates that settlement on the proposed terms would give it an increase of around $30 million more than it received in the 1954 base year.

Zwerdling's formula . . . By contrast, the one-price plan proposed last year by FPC examiner Joseph Zwerdling would provide an increase of only $14 million.

Much of the price spread between the two methods is accounted for by the difference in computing tax benefits. Under Zwerdling's plan, the company would be barred from the intangible drilling cost option and from percentage depletion benefits.

(FPC rulings recently in cases involving production by pipeline companies indicate that the commission would overrule Zwerdling on this point.)

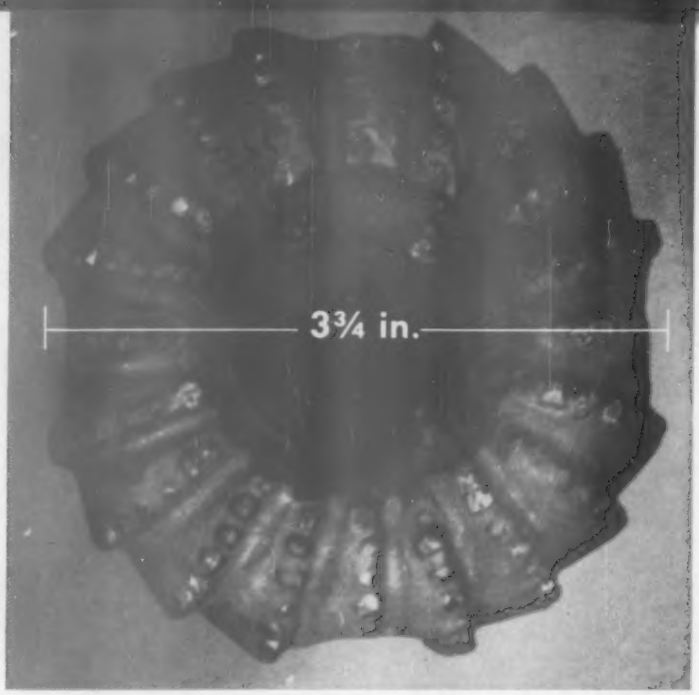
The apparent advantage of the Phillips proposal over Zwerdling's is that it would eliminate the individual price adjustments which would have to be made if the Zwerdling approach were used. The latter, since it would set one system-wide price for Phillips, would necessitate an increase in some contract prices and a decrease in others.

The FPC staff is now making a preliminary study of the Phillips settlement offer, but no immediate action is considered likely.

If the commission should decide to consider the Phillips plan, it likely would require a hearing to give intervenors and the FPC staff an opportunity to present their views.

However, the commission may make the Phillips proposal a moot one by announcing its own decision in the case.

ACTUAL SIZE of the 3¾-in. Hycalog diamond bit used in a deep Hunt Oil wildcat is shown in photo at the right.



Small Bit Used in 20,000-Ft. Texas Wildcat

WHO SAYS you can't make hole with a little bit in deep, hard formations?

Drilling engineers for Hunt Oil Co. put this one in the same class with an old wives' tale. And they have proof in case anyone would like to argue the point.

Hunt has made increasing use of little bits in its drilling operations since 1952. It has used them extensively in the past few years with impressive results in the Alto Loma area of South Texas. The company applied the real clincher, however, by using a 3¾-in. diamond bit in the deep section of a 20,603-ft. rank wildcat now testing in Webb County, South Texas.

Penrod Drilling Co.'s Rig 4 spudded in this test for Hunt in July last year. The hole was bottomed out in less than 7 months. This is spectacular time for a hole of such depth. And it was made despite the fact that more than a month of drilling time was lost due to severe lost-circulation trouble.

Drilling was completely stymied at 10,338 ft. while operator fought to regain circulation and set pipe. Not a foot of hole was made between September 2 and October 11 last year.

Lost circulation and high pressures continued to plague the operation until Hunt set 7-in. liner casing at 14,791 ft. in December. From that point on, the rest was a breeze.

Starting December 24, operator chewed up 4,400 feet of hole in 45 days using 6-in. diamond bits. The interval from February 7-17 was consumed in testing and running 4½-in. liner.

14 days to TD! . . . Hunt then switched to 3¾-in. diamond bits and proceeded to shoot another "old wives' tale" full of holes. Drilling in hard Edwards lime—operator blazed down the remaining 1,419 ft. of hole to 20,603 total depth in 14 days!

Average daily footage was 110 ft. And average footage per rotating hour was slightly over 5 ft.

It took only three bits to make this stretch of hole. Bit No. 1 made 259 ft. in 46.3 hours, for an average 5.6 ft. per hour. Bit No. 2 drilled 489 ft. of hole in 104½ hours (4.7 ft. per hour). And Bit No. 3 ripped off 671 ft. in 137 hours (a 4.9 ft. per hour average).

Over-all bit cost per foot of the entire diamond-drilled section of the hole (including both 6-in. and 3¾-in.) was $3.68. Cost of the 3¾-in. hole ran just $2.57 per foot.

Gordon Rowe, drilling engineer for Hunt, feels such bit costs at the depth are quite reasonable. "If we had been using rock bits in that formation, we would have had to pull them about every 7 hours. At that depth, a round trip takes around 15 hours. So we probably wouldn't have been finished yet."

Rowe says the small hole and fast drilling time saved Hunt money not only on rig time but on its mud bill. Furthermore, it saved the contractor considerable wear and tear on the rig as well as requiring a smaller investment in the drill string.

Circulating pressure, the key . . . For its tiny 3¾-in. hole, operator used a swedge drill string—4½-in. drill pipe on top, 3½-in. through the 7-in. liner, then 2⅜-in. with ten 3⅛-in. drill collars above the bit.

Hook load was not large for the depth. Weight on the bit in the 3¾-in. hole was maintained between 3,000 and 4,000 lb.

The key to the drilling speed in the small hole, Rowe says, is the circulating pressure of the mud stream. "You must have adequate hydraulics."

To determine what was "adequate," Hunt used the pumps on a cementing

Bit Record for Deep End of Deep Well

Bit No.	Size	Depth Out	Feet Drilled	Hours Drilled	Ft. Per Hour	Bit Price	Salvage	Net Bit Cost
85	6-in.	15,730	646	138.7	4.6	$ 3,950	$ 1,532	$ 2,418
86	6-in.	16,306	576	100.0	5.8	3,831	1,546	2,285
87	6-in.	16,783	477	99.0	4.8	3,870	1,097	2,773
88	6 in.	16,918	135	64.0	2.1	3,900	2,616	1,284
89	6 in.	17,913	995	198.5	5.0	3,951	1,669	2,282
90	6 in.	19,041	1,128	224.7	5.0	3,877	1,047	2,830
91	6 in.	19,184	143	33.0	4.3	3,700	778	2,922
92	3¾ in.	19,443	259	46.3	5.6	1,945	640	1,305
93	3¾ in.	19,932	489	104.5	4.7	1,855	809	1,046
94	3¾ in.	20,603	671	137.0	4.9	1,651	555	1,096
TOTALS	.....		5,519	1,145.7	Av. 4.8	$32,530	$12,289	$20,241

truck to fluctuate the mud circulating pressure between 2,000 and 3,350 psi.

It found that in the small hole, 2,400 psi. was about right.

With adequate hydraulics, Rowe maintains, you can make just as good and probably better time with a small bit. "It's just like sticking your finger with a sharp pencil as against a blunt one."

Through the 6-in. hole, operator found optimum circulating pressure to be about 2,200 psi. Weight on the bit through this section, using 22 4⅛-in. collars atop the bit, averaged about 10,000 lb.

Heat poses problems . . . From 15,000 ft. on down to total depth, the 1 J. O. Walker drilled with less trouble than at any other time. But, though there were few headaches in actually making hole, terrific downhole heat created some serious problems.

The highest temperature recorded was the last one taken while running log at 20,571 ft. It read 456° F.

Operator decided to set 4½-in. liner and test the Edwards when the bit reached 19,184 ft. A temperature survey at 19,036 ft. checked out at 424° F. As a safety measure, Hunt checked with perforating firms to see if they could perforate the liner in such heat. None of them had equipment which could do the job.

Operator thus had to set the liner up the hole to 18,560 ft. and test in open hole.

Likewise, Hunt found that it was impossible to run a porosity tool in such heat. There were plenty of tools small enough. But in two attempts, the tools simply "blew up" before they even reached the desired depth, Rowe said. This occurred at about 17,800 ft. where the temperature ran about 384° F.

Big mud bill . . . Though the extreme heat created some headaches, it did not cause serious mud problems.

Hunt used a calcium surfactant mud from 10,178 ft. on down with little difficulty in the hottest part of the hole.

Due mainly to the extreme lost-circulation trouble at 10,000 ft. and severe gas-cutting of the mud stream between 10,000 and 15,000 ft., however, total mud bill for the 1 Walker soared to more than $250,000.

Operator drilled through solid shale from well above 10,000 ft. to 15,000 ft. Throughout this stretch, Hunt struggled fruitlessly to maintain mud weight at 17 lb. per gallon as shale gas constantly cut the mud well below this weight. "We finally had to go ahead and learn to live with it."

Before switching to the calcium surfactant mud, Hunt used a natural mud to 300 ft., a phosphate mud to 6,478 ft., and a gyp Q Broxin mud to 10,718 ft.

Hunt set 20-in. surface casing in the 1 Walker to 300 ft., 13-in. to 6,478 ft., 9⅝-in. to 10,338 ft., 7-in. liner to 14,791 ft., and 4½-in. liner to 18,560 ft.

Hole size was: 26-in. to 300 ft.; 17½-in. to 6,478 ft., 12¼-in. to 10,338 ft.; 8⅜-in. to 14,791 ft.; 6-in. to 19,184 ft.; and 3¾-in. to 20,603 ft.

Crude Price Weakness Shows up in New Areas

Reduced postings in Texas and Rockies come as officials of prorated states move to slow down oversupply of oil.

CRUDE prices over a wide area of the oil country continue under heavy pressure after reductions were posted last week in four different regions.

The cuts came while state and industry efforts were being made to reduce the oversupply of domestic crude with lower allowables and buyer proration.

All the reductions were termed adjustments to bring the price of crude into line with its value as products. Refiners, caught in a squeeze between weakening product prices and high crude prices, chose to get into balance by cutting the crude.

Latest areas to feel the price cuts are North Texas, East Texas, the Corpus Christi area of Southwest Texas, and the Rocky Mountains.

North Texas and the Rocky Mountain areas are particularly tender spots. If other buyers adopt the new postings, the cuts could spread.

Who cut . . . The North Texas cut by American Petrofina Co. of Texas was the largest—19 cents—and it set off the most immediate commotion.

Petrofina moved the top price from $3.01 to $2.82 on 5,400 bbl. daily it buys in Archer, Baylor, Clay, Jack, Knox, Stephens, Throckmorton, Wichita, Wilbarger, and Young counties.

Evidence of opposition to the cut came immediately.

Independent producers in North Texas held a mass meeting in Wichita Falls, protesting the unfairness of the price cut.

Continental Oil Co., which also operates a refinery at Wichita Falls, offered to buy from 2,000 to 3,000 bbl. daily of the affected crude at the old $3.01 price. This offer was interpreted as a move to protect the price of Continental's own production.

Part of the crude affected by American Petrofina's cut comes from West Central Texas, where earlier in the month Premier Oil Refining Co. posted a 10-cent cut on about 9,000 bbl. daily. However, the North Texas cut was the first since February 1959, when all buyers finally adjusted downward 7 cents to the $3.01 level.

The Rocky Mountain reduction was made by Sinclair Crude Oil Co. It was a 5-cent cut from $2.98 to $2.93 on 32,000 bbl. daily of sweet crude. Also it was the first price move in that region since early February, when Shell cut 15 cents a barrel off 30,000 bbl. daily in Montana, North Dakota, and South Dakota.

Sinclair cut East Texas-type crude 15 cents from $3.25 to $3.10 a barrel and Corpus Christi southwest heavy-type crude 10 cents from $3.30 to $3.20 a barrel. About 20,000 bbl. daily was involved in East Texas and 9,000 bbl. daily at Corpus Christi.

The East Texas move has been long expected since Atlantic Refining first posted a 20-cent cut there more than a year ago. Then earlier in the month, Premier posted a 10-cent cut in East Texas. The Southwest Texas changes are part of a price-nibbling trend that has been going on along the entire Gulf Coast.

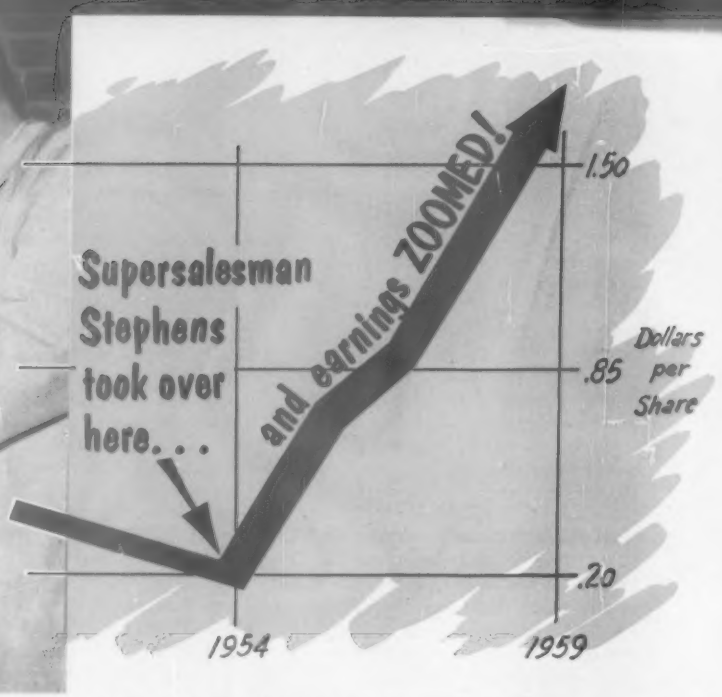
In the last 15 months a total of 1,109,950 bbl. daily of domestic crude has been reduced in price, the cuts ranging from 3 to 25 cents a barrel.

The outlook . . . This nearly constant shifting is expected to continue as long as domestic crude remains in oversupply.

Oil marketers doubt that any sweeping general reductions will follow last week's cuts. Instead, other buyers gradually may move to meet the competition as their individual economics dictates.

Prorated states have moved to alleviate the oversupply by slowing down production. Louisiana and New Mexico reduced their allowables. Texas and Oklahoma were under pressure to cut theirs more.

In addition, several buyers are prorating purchases.



CHAIRMAN WITT STEPHENS is Arkla's top salesman, urges employes to follow his lead.

SPECTACULAR EARNINGS RISE—from 18 cents to $1.68 per share in 5 years—measures Stephens' promotion success.

Aggressive Selling and Offbeat Ideas

Expand, sell, diversify, stimulate, and actually build new industry—this is the policy that has created markets for Arkansas Louisiana Gas Co. Its development of gas air conditioning and other big load builders has made Arkla a model of how to boost year-round gas sales.

GENE T. KINNEY
Assistant Pipeline Editor

NEXT FRIDAY a resident of the Arkansas-Louisiana-Texas area will turn off his TV and leave the comfort of his year-round gas air-conditioned home for a weekend of fishing.

This ordinary drama will be enacted elsewhere, too, but for the Ark.-La.-Texan there will be a difference. He will be escorted every step of the way by a most remarkable gas company.

This company not only supplies the gas that heats and cools his office and home; it also makes the heating and cooling equipment, the pressure regulator, and this year will start producing the meter that measures the gas.

It makes the rocking chair in which he relaxed in his club room and the vintage buggy that bounced through the TV western he was watching. It even had a role in providing the soft drink he was enjoying.

This company processes and sells the fuel which powers his automobile. It makes the cement in the highway leading to the lake and the dam that formed the lake. It also makes the boat from which he plugs for large-mouth bass.

All this, you ask, is the gas business?

It's the gas business as conducted by Arkansas Louisiana Gas Co., of Shreveport. This old company's rebirth

SIGNS, LAMPS They're significant gas users, and advertisements as well.

CEMENT Arkla created an industry—and a big gas customer—where there was none before.

THEY'RE COOKING WITH GAS—and heating, and cooling, and lighting, too, at this new Little Rock, Ark., motel, an object lesson in gas-load building. A gas-engine generator even provides all power needs.

Spark Rebirth of Arkla Gas

the past 5 years has seemed quite unorthodox. But its seeming unorthodoxy arises largely because it is doing what many others only talk about: It is creating markets for natural gas.

Boats and buggies and air conditioners attract a lot of attention; but how do they affect the balance sheet?

The answer is found in the steeply rising slope of the earnings curve in the chart on the opposite page. Enterprises that did not exist 3 years ago are today producing more revenue than all company operations in 1954, the last year under the previous owners. Net income the past 5 years has increased eightfold.

This record was achieved through a philosophy of expand, sell, diversify, and build the area the company serves—all in order to sell more gas. And behind this philosophy is a man named Wilton Robert Stephens.

The old Arkla . . . The venerable wildcatters, M. L. Benedum and J. C. Trees, could not have known what they were starting back in 1908.

That year marked their discovery of a gas field in the Shreveport area and the construction of a pipeline to Little Rock. Thus was born the system that is now Arkansas Louisiana and, coincidentally, Witt Stephens entered the world at about the same time.

A member of the Cities Service Co. family, Arkansas Louisiana was orphaned by the Public Utility Holding Company Act of 1935. After a drawn-out legal battle between the federal Government and Cities Service, it was finally sold in December 1954.

Its principal asset was a plentiful supply of gas at rates far below any competing fuel.

Arkansas Louisiana was in a business where expansion is essential to survival. But its service area (Northeast Texas, Arkansas, and Northwest Louisiana) had certainly experienced no population explosion and, in fact, portions had actually declined in population. Largest cities are Shreveport (161,000) and Little Rock (107,000).

BUGGIES Factory revived area, was built in frontier setting which promotes company and products.

BOATS New growth enterprise creates jobs, more gas business, and makes money, too.

RETAIL MARKETING of motor fuel, upgraded from Arkla plant products formerly wholesaled, is done at new service center which also is showcase for Arkla-made items.

Industrial markets had begun to open up. But the region has a short heating season, and so does not have the lucrative space-heating market which has been the basis of huge lines to the North and East.

Couple these factors with the major problem of all gas companies—low demand during the summer—and you see the challenge confronting Arkansas Louisiana at the end of 1954. It had definite possibilities but it was no plum ready for plucking.

Enter Witt Stephens . . . Onto this stage strode Witt Stephens, the one-time belt-buckle salesman, now a successful business man in the finest self-made tradition.

A farm hand and trapper in his youth, Stephens left Sheridan, Ark., high school 3 months before commencement "to help make a crop."

He soon embarked upon the unlikely career of belt-buckle salesman. In what was to become typical Stephens fashion, he so impressed the boss that he was asked to hire and teach other salesmen and later was promoted to sales manager.

He was early intrigued by the securities investment field, of which he became a serious student. When the belt-buckle business went to pot in the depression, he got a job in a Little Rock brokerage office; 3 months later he quit to found W. R. Stephens Investment Co. in 1934.

His company prospered and in the next 20 years became the major factor in the market for Arkansas municipal bonds.

When Cities Service was trying to dispose of its stock in Arkansas Louisiana, Stephens' investment firm became involved in the negotiations. It was a surprise to the industry—and perhaps to Stephens himself—that his firm emerged with Cities Service's 51½% ownership. All of the stock was sold to the public during the next 2 years, with no stockholder owning as much as 5%.

On January 1, 1957, Stephens resigned as president of the investment company to become chairman, and later president as well, of Arkansas Louisiana. The company was for the first time entirely publicly owned and also Witt Stephens' main interest.

New blood for Arkla . . . Observers see in Stephens a touch of P. T. Barnum, the gambler, and a bit of the cheerleader, and he has the Scotsman's aversion to corporate fat.

One of his first moves was to trim the payroll sharply. Then he set about remolding the leadership to his own style of executive. Of the six vice presidents now with the company, only Earl P. Farmer, an old-timer in Arkla, was in the top-management group in the pre-Stephens era.

The youthful new guard includes D. W. Weir, 46, executive vice president who came up from personnel manager and assistant to the president; Edward N. Henderson, 37, elevated from acting chief engineer to vice president and chief engineer; B. E. Harrell, 36, vice president of gas supply and sales, formerly manager of gas supply, and James C. Templeton, 36, brought in from an oil company to be vice president in charge of exploration, leasing, and production. Lindsey Hatchett had handled various special assignments before being made a vice president.

The new Arkla . . . Under new management Arkla took off like a rocket.

Stephens first attacked the low summer-load problem. This proved to be but the first of a dizzying series of moves to build business and free the company from the stagnation brought on by years of federal litigation before its sale. The moves include:

. . . Air conditioning. Arkla Air Conditioning Corp. was formed in 1957 to buy the gas air-conditioning manufacturing facilities and patents from Servel, which was ready to throw in the towel. Sale price was over $4 million.

In 1 year an intensive research and development program produced new and improved equipment of great significance to the industry. Arkla—and the gas industry as a whole—for the first time had a quality unit that could compete with electricity for the air-conditioning load.

. . . Gas lights. Decorative gas lights were manufactured and sold nationally, adding another load builder equal to a gas range.

. . . Heating equipment. The Humphrey line of gas-heating equipment was bought in April 1959. The manufacturing facilities were moved to the Evansville, Ind., air-conditioning plant.

. . . Gas signs. A competitor for electric signs was developed and will be marketed nationally.

. . . Arkla Village. Near Emmet, Ark., the company used idle Arkla land to re-create a frontier town of the gas-light era. It is here that Arkla manufactures horse-drawn carriages and carts, harness and horse collars, and a line of American period furniture.

. . . Gas meters. A plant was started to make service-type gas meters at Russellville, Ark.

. . . Cement. Arkansas Cement Corp. was formed in 1957 to build a $12 million cement plant at Foreman, Ark., near a plentiful supply of limestone raw material.

. . . Chemical business. Arkansas Louisiana Chemical Corp. was organized in April 1958 to manufacture and sell motor and natural gasolines, LPG, butane, propane, and various petrochemical products and chemicals.

The chemical company owns one products-extraction plant and leases seven others from the parent firm. In 1958 it acquired a 20-year lease on a

government-owned plant at Pine Bluff, Ark., and started producing chlorine and caustic soda (used for washing soft-drink bottles) and selling them in the Midsouth and Southeast.

The chemical company also has entered retail marketing with service centers selling a complete line of branded motor fuels and motor oils formerly wholesaled.

. . . Regulators. Reynolds Gas Regulator Co. was purchased in November 1958 to provide another standard gas-industry product to Arkla's growing line.

. . . Pipeline construction. In January 1958 Arkla found an opportunity to enter pipeline contracting for a small investment and purchased Pitts & Bryant Co., Inc., to build lines for itself and other companies.

. . . Boats. Razorback Fiberglass Corp. was purchased and a new plant with annual capacity of 7,600 sports and pleasure boats was built near Malvern, Ark.

. . . Industrial pipeline. Arkansas Industrial Pipeline Corp. was formed in September 1958 to build and operate a 130-mile, 18-in. intrastate gas line from Malvern to Helena, Ark. It will be completed this year and will transport gas to supply domestic, commercial, and industrial customers in a new area of Arkansas, and supply all fuel requirements of a new 325,000-kw. electric generating station at its terminus.

The score . . . Net income last year was $16,008,052 compared with $1,866,847 in 1954.

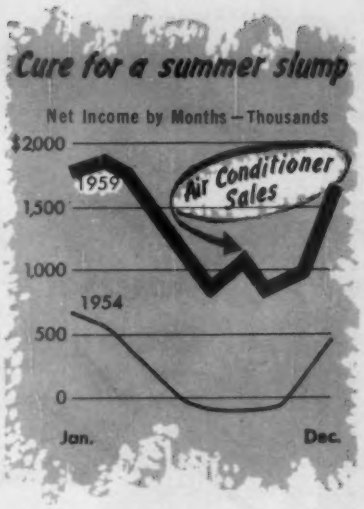
Gas sales have increased from 181,114,945 M.c.f. to 229,965,771 M.c.f.; average annual gas use per residential customer from 92 to 112 M.c.f.; total customers from 233,872 to 284,936; industrial customers from 1,798 to 2,139; and total communities served from 142 to 196. In January this year Arkla had its first billion-cubic-foot day, and with no service curtailment.

More than 20,000 of the new direct-fired, single-coil, Arkla Sun Valley year-round air-conditioning units have been put into service. Shipments last year were up fourfold over 1957, up one-third over 1958. Of greater significance to Arkla, and the gas industry, was the fact that several utility customers of Arkla were able to penetrate the new home-building market with large-volume sales.

All of the new enterprises prospered.

Arkla philosophy . . . The company's load-building philosophy has been spelled out by Executive Vice President Weir:

"I am not suggesting that money be lost on any merchandising promotion, but I am suggesting that we promote or merchandise gas-burning appliances with the idea that our profit is derived from the sale of gas, not from the sale of items which burn gas."



RED INK has been removed from the income chart, which now has a mid-summer upturn.

The successful promotion of air conditioning and other gas-burning equipment has put a summer hump in the monthly income curve above.

The cement, boat, and Arkla Village enterprises are instances of the company's policy of going beyond the usual encouragement of industry. It actually stepped out and built industries that will burn large volumes of gas, will employ people who will be gas customers, will stimulate further development, and will offer diversification and publicity as well.

Arkansas Louisiana also issues free grants of 1,000 bbl. of cement to non-profit industrial development groups that are trying to provide facilities for new industry.

Every employe a salesman . . . Stephens the cheerleader, with his regular sales pep rallies, has really made this often-tried technique work.

And the top salesman is Witt Stephens himself. "I consider myself one of the company's hired hands," he says, and is fond of describing himself as "assistant sales manager."

But the boss lets employes know what is expected of them, especially where sales are concerned. Sales-department personnel conduct classes for supervisors who in turn train their own departments in gas promotion. Local managers are expected to act as salesmen.

A bonus and incentive program has been started. And every employe carries an order book in his pocket.

Nor does Arkla stop with the employe—the entire family is indoctrinated.

Each employe receives in his home copies of the annual report, quarterly report to stockholders, the company magazine, and newspaper. Weekly digests of company activities go to all departments.

A heavy round of employe and family social events further cements company support.

Success of the program is measured by sales results. There were 19,839 gas lights sold and installed on the system last year, boosting total system sales to 44,341 since January 1, 1958. Some 90% of sales last year were made directly to the buyer by employes of all job descriptions. In a campaign just completed over 5,000 gas driers—another gas load builder—were sold in 2 months, a record for any utility in the country.

Although a tough-minded boss, Witt Stephens has the support that comes from seeing his methods work. Some 42% of the employes have bought stock in the company.

If Stephens bought a dead horse and entered it in the Kentucky Derby, the odds are that his employes would lay $2 on its nose. A conversation with employes from top to bottom shows they feel they are riding with a winner.

What next, Mr. Stephens? . . The next candidate to join the Arkla family is Consolidated Gas Utilities Corp., a gas-transmission and utility firm with operations in the Texas Panhandle, central and western Oklahoma, and southern Kansas.

Directors of the two companies have agreed to a merger, pending approval of stockholders and regulatory agencies concerned.

Consolidated is a going concern with 1959 earnings of $1,438,264 and assets of $38 million to add to Arkla's $157 million. The merger would provide 90,000 more customers for Arkla-produced gas-burning equipment, plus a new area to develop with the methods that have worked so well in Ark.-La.-Tex. The new company would give the exploration and production division a hot new territory to exploit plus an opportunity to buy, sell, and swap gas.

Several other developments are in the offing:

. . . Electric generation. A new sales department has been organized solely to promote gas-engine-driven generators. The target is commercial and industrial plants and buildings. The aim is to make gas the fuel source for all

heating, air conditioning, power, and lighting.

... Air conditioning. Two new types of year-round gas air-conditioning units will be introduced this year: The Sun Valley remote for outside installation and a direct-fired water chiller-heater in a self-contained unit, which requires no outside source of energy such as steam.

Also new this year: An oil-fired version of Arkla's absorption-type year-round gas-air conditioner.

... Gas lights and gas signs. New models this year will be automatically controlled by means of electric energy generated by the gas flame itself.

... Boats. Fiberglass boats will be marketed nationwide, and other fiberglass products will be developed.

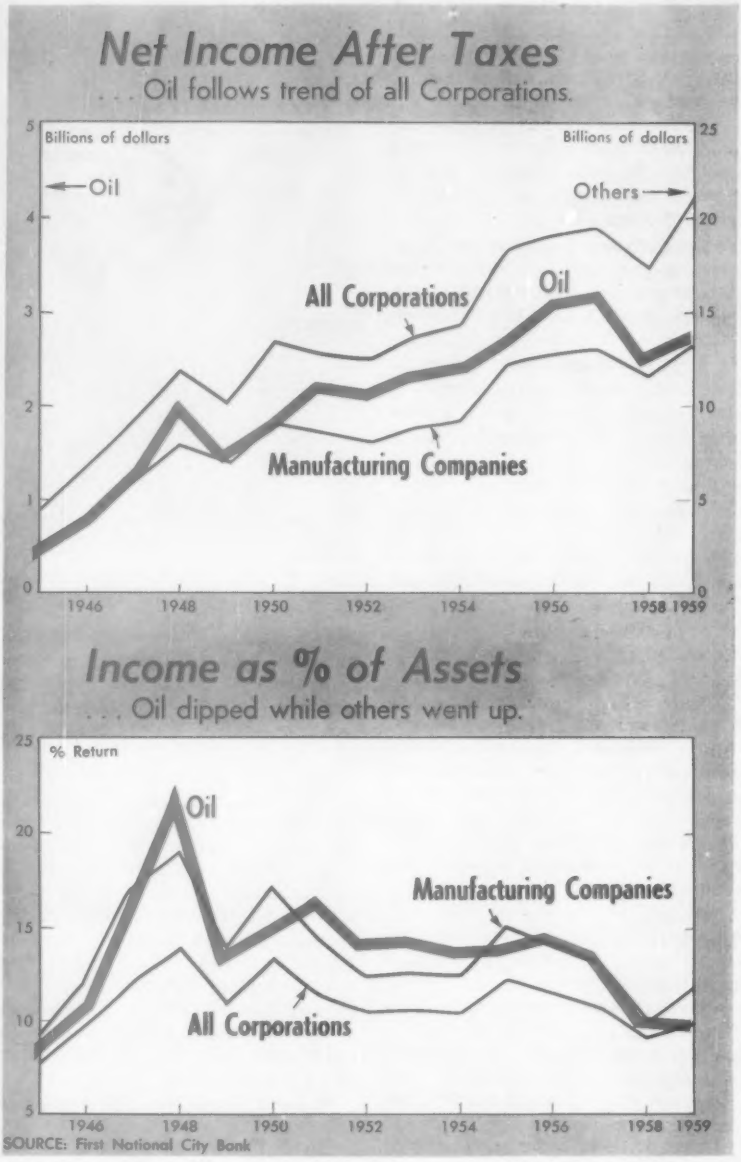
... Gas sales. The company will continue to provide service to new communities, whose present gas load would not justify a connection, through lease-purchase agreements with municipalities. Arkla contracts to operate the system financed by the community, retaining an option to buy, and lays a lateral to the city gate. This creates new business ahead of schedule, provides for growth in the future. The new line to Helena also will open up new expansion areas.

... Production. Expanded exploration and production is planned to increase Arkla's position of supplying 20% of system needs from its own wells. The fact that it operates in "fair-field price" states, and thus is permitted the going rate for its own produced gas instead of cost plus 6%, offers a lure to increase this activity. Less than 10% of Arkla sales are to interstate pipelines which are subject to Federal Power Commission control.

... Marketing. A second service center has been opened, this one at Little Rock, and five more are planned this year. Besides selling Arkla products, the stations will have drive-in windows where gas customers may pay bills and stations will serve as showcases for other Arkla-made items.

... Chemicals. With a source of ethane from a new plant and large volumes of propane, petrochemical expansion is planned. Other projects are being considered: The production of sulfur, and the mining, processing, and sale of bentonite.

Hydrochloric acid will be marketed this year, mainly for use in acidizing of oil wells. Nor will this be the end of the chemical chain, as was indicated by Ed Henderson and Earl Farmer who paused during an interview to muse: "Now, I wonder what we can make of hydrochloric acid."



Oil Firms Did Better in 1959

OIL companies as a whole did better in 1959 than they did in 1958. But their performance wasn't up to that of other industries.

In fact, a study by First National City Bank of New York, shows that while oil companies' combined income rose, their return on investment dropped to the lowest point since World War II.

The number of oil companies included in National City's study varies from year to year, but they are close enough to indicate trends. According to the bank's figures, oil companies netted 10% on their net assets last year. The year before the figure was 10.2%. Low point in recent years was 1945, when the figure was below 9%.

While oil showed a drop, others were up. Manufacturing companies as a whole made 11.6% on their assets, up 1.8%. All companies covered in the study had an average of 9.8%, up 0.8% from 1958.

Oil's return on investments hit a high of 22.7% in 1948 and has declined steadily since then except for a recovery in the mid-50's. The bank's study is based on annual reports to stockholders.

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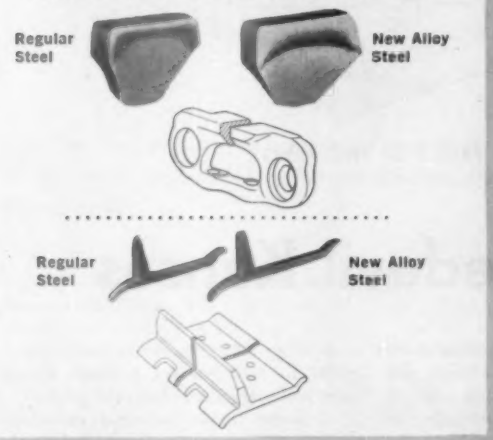
...cost less per hour

OPTIONAL TRACK GROUPS

up-date D9 or D8 Tractors for longer undercarriage wear

Now, two types of track groups are available for older model D9 and D8 Tractors . . . regular and optional, allowing you to tailor your undercarriage parts to meet job conditions.

Lighter tones at top of etched cutaways show depth of special hardness in wear zones.



REGULAR track parts are made from durable steel. They're heavy-duty, long-lived, special-hardened to resist wear.

OPTIONAL track parts are equivalent to those used on current production model tractors. The links and shoes are made from Caterpillar's new alloy steel that is hardened much *deeper* than regular steel. Link rails are hardened twice as deep. Shoe grousers are hardened 400% deeper. The new alloy steel also provides greater strength with more impact resistance.

MORE METAL WHERE IT COUNTS. Optional components are king size. Every part is beefed up and made bigger with more *hardened* steel in wear areas.

BORALLOY "HUNTING TOOTH" SPROCKETS are another new feature of the optional groups. Every other tooth is used in one revolution, alternate teeth being picked up the next revolution. This alternation means that teeth contact the bushings only *half as many times* as do regular sprocket teeth. More important are the teeth themselves—they're *machined* for exact fit with the big bushings. This greatly extends bushing life.

COMPARE regular and optional track components:

	Pitch	Pins O.D.	Bushings O.D.	Track shoe bolts and nuts	Sprocket
D8	regular 8 inches	1 3/4 inches	2 3/4 inches	3/4 inch	14 tooth
	optional 9 inches	2 inches	3 inches	7/8 inch	25 tooth
D9	regular 9 inches	2 inches	3 3/16 inches	7/8 inch	28 tooth
	optional 10 1/4 inches	2 1/4 inches	3 3/8 inches	1 inch	25 tooth

HOW MUCH MORE LIFE? Variation in the length of track life occurs because components have different wear rates under various soil and job conditions. In sand, pins and bushings wear faster. In rock, shoes and links wear faster.

ON-THE-JOB TESTS confirm that the new optional track components are giving up to 40% more life than the regular parts. On many applications, you can expect even greater wear life.

CORRECT TRACK GROUP SELECTION IS IMPORTANT. It depends on job types and conditions. Let your Caterpillar Dealer analyze your track needs. He'll recommend the correct components to help you get maximum life at the most reasonable investment. Call him soon.

SERVICE TIP: FREE! Handy reference for ordering track options. "New Options for D9 and D8 Tractors" includes part numbers that are used to adapt to your older models. Pick up a copy at your Caterpillar Dealer's.

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Here's more on the need for an overhauling of Kansas' outgrown oil laws. A Journal reporter points out how . . .

PART 2 OF TWO PARTS

Spacing Headaches Bedevil Kansas

Robert J. Enright
District Editor

ONE OF Kansas' most crying needs is for legislation to bring some order out of its present chaotic well-spacing situation.

The Jayhawk State has no spacing law as such. In spots the corporation commission has achieved reasonably regular spacing by using its allowable-setting power. But such instances, operators say, are far too few. And the commission's freedom of action in this field is limited.

Some feel, in fact, that any commission move to control spacing by manipulating allowable is on shaky legal grounds in the absence of a law specifically spelling out such authority. At least one court action is now being prepared to test the commission's power in this regard. An operator whose allowable was slashed for crowding his lease line is taking the issue to court.

If the commission should lose out, the scant progress made so painfully to date in the absence of a basic spacing law would promptly go up in smoke.

The commission's authority to exert some control over spacing via its power to set allowables is vested in General Statute 55-604.

As amended effective July 1, 1959, this law states that the commission may cut a well's allowable below the 25-bbl. statutory minimum in a "spaced" pool when the acreage attributable to that well is less than the number of acres in the spacing unit set up for the field by the commission.

The reduction would be proportionate according to attributable acreage as against spacing-unit size. For instance, a well completed on a 4-acre tract in a field spaced in 20's may, instead of getting a 25-bbl. allowable, be cut back to 5 bbl. daily.

Further, in nonspaced pools, a well's allowable may be cut below 25 bbl. if its attributable acreage is less than 10 acres. Here, again, the reduction is proportional to the amount of acreage attributable to the well as it compares to 10 acres. Thus, a well with only 2 acres attributable could be cut back to 5 bbl.

Attributable acreage is determined by size and shape of the tract and by proximity of the well to the lease line.

This, many operators feel, is a poor substitute for a real spacing law. Here are the reasons why:

1. The statute does not say that the commission "must" or "shall" cut an operator's allowable when he crowds a lease line. Nothing is done unless an adjoining operator formally seeks relief. And then the commission "may" take action.

2. The commission has indicated it generally will not act in cases where new wells are drilled in old pools.

3. Some operators—and including a few majors as well as independents—feel that the law now used is unfair. The reasoning is that it prevents an operator from economically drilling a small lease (under 10 acres) while at the same time there is nothing in the law to compel a neighbor operator to pool acreage with him. Thus, he must sit and be drained.

Some of the producers who criticize the 10-acre provision say they would not object to a compulsory pooling law and would, in fact, support it.

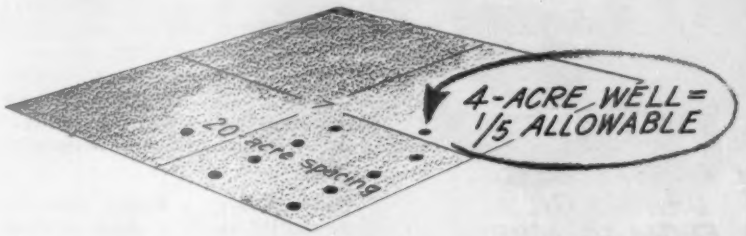
4. There is a fourth objection to attempting to discourage lease-line crowding by cutting the allowable of the offending well. That criticism is that the allowable cut cannot be enforced where there are other wells on the same lease.

Operator X says, "You simply can't effectively supervise it. The only way would be to have a commission man sit on the well night and day or to require that the well produce into a separate tank."

The only effective means of discouraging lease-line crowding where there are lease allowables, he contends, is "to prevent him from drilling close to the line. And the commission doesn't have this power."

There are few Kansas operators who don't recall having been victimized due to lack of a good spacing law.

There currently is a case in district court in Kansas which vividly illustrates this. In this particular case, a large operator took the lead several years back in forming a unit in a field prior to starting a water flood. The company was unable to persuade the owner of an undeveloped lease on the edge of the pool to join and finally went ahead and launched the project anyhow.



". . . For instance, a well completed on a 4-acre tract in a field spaced in 20's may, instead of getting a 25-bbl. allowable, be cut back to 5 bbl. daily."

As soon as the flood was well under way, the owner of the undeveloped lease proceeded to drill a string of producing wells within a few feet of the lease line and produce the oil moved by the flood.

To protect itself, the company doing the flooding was forced to drill a string of input wells along the other side of the lease line. The offending operator's wells were soon flooded out.

The latter filed suit for more than $1,000,000 in damages.

And this was not an uncommon occurrence. Other operators tell the Journal of similarly getting swept up in such "line wars."

This is less likely to happen now than it was a few years ago. But it illustrates well the extreme waste that can occur in the absence of a good spacing law.

Wide spacing difficult . . . Operators contacted by the Journal were virtually unanimous in complaining of the difficulty of attaining wide spacing in Kansas.

Operator A complains that "about the only time you can space wide is when you are able to assemble a large, solid block of acreage."

"Many attempts at wider spacing—40 and 80 acres for oil—have been undone because another operator comes in and offsets you on 10 acres while action is pending on your spacing application."

"The commission may go ahead and adopt 40-acre spacing for the new field. But it must give an exception to its order to all wells previously drilled or started on closer spacing.

"And this gives the offset operator the legal right to drain us."

Operator B adds a fervent amen. He recalls that in one case, a producer opposing another operator's proposal for 40-acre spacing for a new field obtained a 30-day recess of the hearing on grounds that he needed more time to prepare his case. He used the recess time to spud in a well in the field on 10 acres. And both the operator making the 40-acre application and the commission were helpless to do anything about it.

Producers gun-shy . . . Many operators, having been stung before, are gun-shy about making further attempts to space wider in Kansas under present regulatory conditions.

A commission source maintains that the agency is quite willing to issue a temporary order to protect any operator who might see the need to develop a new field on wide spacing. Such an order, he says, would prevent other operators from drilling until spacing was approved.

Many operators, however, take this with a grain of salt. They doubt that the commission is able or willing to act with the necessary dispatch.

Operator C complains that it took the company more than 6 months to get a 40-acre spacing order approved for a new field—and that in the interim several wells were drilled on much closer spacing by other operators. The Journal study found this to be a frequent complaint.

The same operator charges that the commission "sometimes doesn't set field rules after a hearing for this purpose—and sometimes its decisions seem to be based more on the basis of the number of operators favoring or opposing or on who does the most shouting rather than on the evidence presented."

Add to this general situation the known fact that the operator may lose what small incentive allowable he is given for spacing wide whenever the commission cuts state-wide production sharply (OGJ, Apr. 11, p. 77). The result, these operators argue, is an unhealthy climate for wider spacing—thus a built-in pressure for high-cost development and high-cost oil.

A good spacing law, they claim, would help work to cut down the large number of unnecessary wells, free this money for more exploration, and in the end add greatly to the state's reserves. Sections 5 and 6 of the Interstate Oil Compact Commission's model statutes, most feel, fill this bill well.

The need for a compulsory pooling law for drilling in Kansas, many think, is at least as great as for a basic spacing law.

Lacking either, any state will suffer much frustration with loopholes it cannot plug, with violations of correlative rights, and other inequities it cannot correct.

Most major companies have long been in favor of a compulsory pooling law in Kansas. They have been supported by a few independents.

Pooling bills were defeated in the last two sessions of the legislature. There are signs, however, that more independents are becoming convinced of the merits of such legislation. And it is virtually certain that there will be further efforts to pass it.

The Hugoton "mess" . . . Growing sentiment for a pooling law can be charged up partly to operator disgust with "the spacing mess" in Kansas' big Hugoton gas field.

Spacing in Hugoton is based on 640 acres.

Without a pooling law, however, the commission has felt compelled to permit an operator with widely separated tracts smaller than 640 acres to pool them so as to drill on one. Thus an operator may drill a full-allowable gas well on a 100-acre lease. He can produce just as much gas from his 100-acre well (if his pooled tracts total 640 acres) as his neighbors can from their regulation-size 640-acre tracts. This, as one operator puts it, is simply "legalized thievery" in that gas reserves under neighboring leases are inevitably drained.

There is a case on record where a Hugoton producer was permitted to pool leases which were 34 miles apart so that he could drill a well on one of them.

"How idiotic," he asks, "can you get?"

Sentiment is strong among the larger companies, too, for a compulsory unitization law for secondary-recovery purposes. Here, again, most independents have been opposed. And pros-

pects for passage of such a law in the near future are not bright.

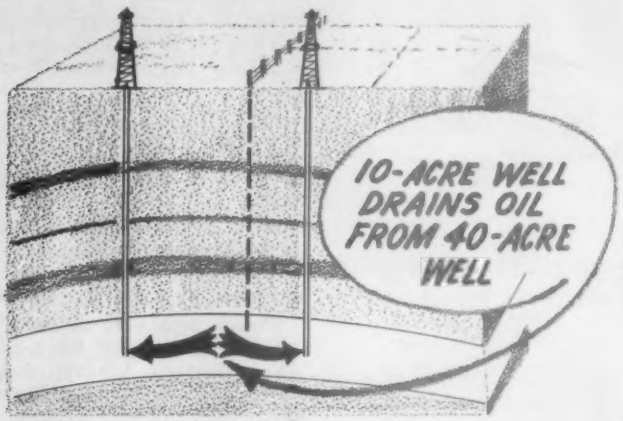
Other than this, most operators appear to have little to gripe about as concerns treatment of secondary-recovery projects in Kansas.

Flooded fields are treated no differently from primary wells unless they operate under special field rules. And this is contrary to regulatory practice in most older oil states. Bonus allowable is granted by the commission in special field rules. But the operator must justify this with evidence showing it to be necessary.

rules, the allowable is determined according to these rules.

In other oil and gas-producing states, gas allowables are granted administratively according to state-wide rules or special field rules, whichever should apply in the particular field.

A kick at featherbedding . . . Nearly all operators contacted by the Journal took lusty whacks also at a similarly bothersome law which requires that a producer must pay a resident Kansas attorney to introduce him if



". . . Many attempts at wider spacing—40 and 80 acres for oil—have been undone because another operator comes in and offsets you on 10 acres while action is pending."

Some major operators find fault with the commission's policy of not permitting transfer of allowables of injection wells to producing wells.

Texas, Oklahoma, New Mexico, and other states permit such allowable transfer. But they also have had and are still having much controversy over the issue of whether floods are getting too big a hunk of the available market.

Operators have long been exasperated over a Kansas statute which requires that a producer must attend a commission hearing before he can get an allowable for a gas well. This takes in both wildcat and development wells.

This is a pointless law which unduly burdens the commission and needlessly wastes the producer's time and money. He must send an attorney and an engineer to attend a hearing even when the allowable is fixed as a matter of course according to state-wide rules.

These specify that, in fields where there are no special rules, a gas-well allowable is 25% of the well's open-flow potential. If the potential is less than 750,000 cu. ft. daily, however, it is exempt from proration. If the well is located in a field with special

he wishes to say anything during a hearing before the commission.

This, they argue, is just out-and-out featherbedding.

A company might be vitally and unexpectedly affected by something which comes up at a hearing in w[h]ich it isn't a principal. The compa[ny]'s representative, however, can't do this unless he has a local attorney to introduce him or "speak for him."

As one operator puts it: "There might be a dozen companies represented at a hearing wanting to state their views on some precedent-setting question which might suddenly arise. They couldn't do it unless each was able to scrounge up a local attorney somewhere." This applies not only to special hearings but to the state-wide variety, too.

The fee for this "introducing" service is $50.

No state-wide GOR . . . Kansas has no state-wide gas-oil ratio rule to penalize oil wells producing and flaring excessive volumes of gas.

"There are a good many wells in the state that are operating at ratios as high as 8,000 and 10,000:1 and flaring the gas but still getting full allowables," one operator says. "This shouldn't be."

Most other operators contacted by the Journal throw in with him on this. And most feel that the 2,000:1 rule applied generally by Texas and other states is a reasonable cutoff point at which to begin to apply penalties.

Late allowables . . . Operators complain, too, that they are not getting the state-wide oil-allowable order for a specified month until that month is already half gone.

This works a hardship on them. They are unable to fill out required forms. Field offices have to guess at what the allowable is and operate on that guess. Pipelines aren't supposed to run any oil until they know the allowable. Usually they take a chance and run on the previous month's schedule.

Myriad fees . . . Kansas producers are chaffed too by a system whereby they must pay small fees to cover the administrative costs of the commission in almost any action it takes.

This is on top of 0.1-cent per barrel statutory tax which is supposed to defer the cost of regulation.

The charge for approving the start or abandonment of a salt-water-disposal project or a water flood, for instance, is $15 for the first lease and $5 for all others.

The producer pays $15 per well for permission to install Reda pumps.

The cost to plug seismic holes is a minimum of $10 per hole or 1 cent per foot. And so on.

The myriad little charges pose a difficult accounting problem. The operator must handle a large number of little checks. The field office has to get approval in some cases to write them.

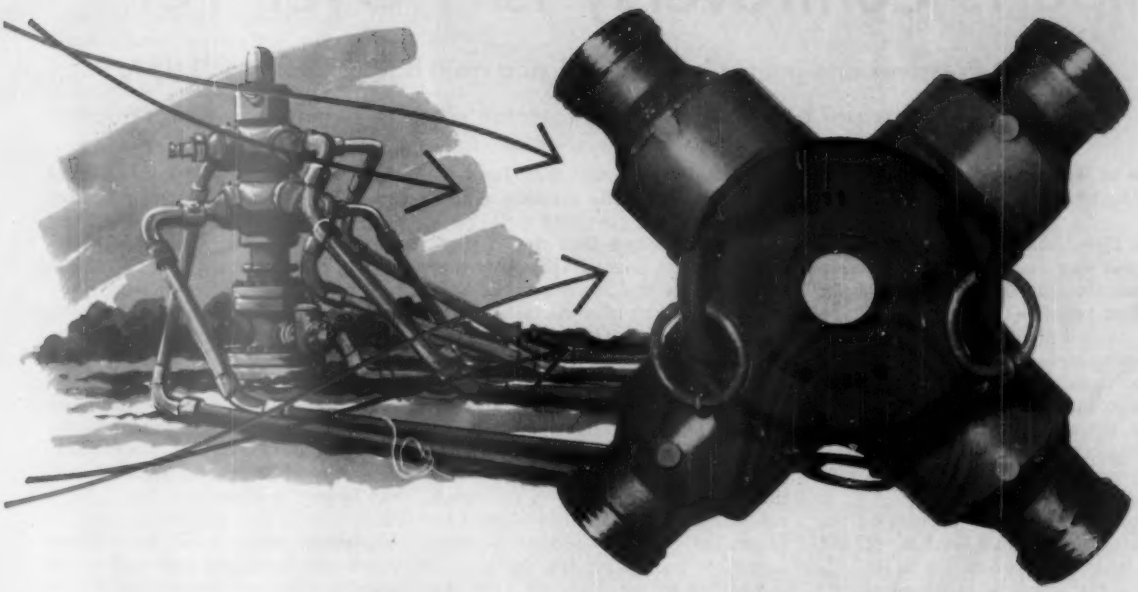
Furthermore, operators complain, the producer bears all of a cost in which the royalty owner should share.

Commission overloaded . . . Operators generally agree that the Kansas commission is overloaded—mainly because of an inefficient procedure wherein the commission itself conducts all hearings no matter how minor or routine they might be.

Most other states have long since adopted use of hearing examiners who are empowered to conduct the hearing, and take evidence on the routine, everyday type of hearing.

The commission itself does not usually conduct a hearing in these states unless it is of a state-wide nature.

Producers heartily recommend this system to Kansas as a means of speeding up action on matters concerning only individual fields and wells.



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Imports Controversy Isn't Over Yet

• Pressures and politics involved in fixing resid figures quotas is likely to keep the imports pot boiling for months to come, despite switch to 3-month quotas.

Clyde La Motte
Washington Editor

IT IS becoming increasingly apparent that the basis used for establishing residual fuel import quotas is the weakest point in the over-all oil import control plan.

Controversy over the resid program flared into the open during recent weeks, and was further heightened when Interior Department announced an increase of 12 million barrels in total residual quotas for the current January-June period.

The net effect of the increase was to boost the original level of 425,000 bbl. daily for Districts 1-4 to 490,934 bbl. a day. This latter figure exceeds the level of imports during the base period year, 1957, when there were no mandatory controls.

Right now, a flurry of public statements are being made by various groups in an effort to fix on someone else the "blame" for the "mess" the program is in.

Varied charges . . . Interior pointed a finger at two culprits: Cold weather in March and "the irregular marketing pattern" of a few major importers. The latter refers to the fact that some of the biggest residual importers already had virtually exhausted their January-June quotas, thereby creating a danger of shortages.

Interior implied that the "guilty" importers had pressed vigorously into new markets and, perhaps, had sold at distress prices in some instances to get rid of the flood of residual they were importing.

Meanwhile, the coal interests were busy leveling charges at both Interior and the big importing companies.

Like Interior, the coal people claimed some importers had caused the trouble by bringing in too much residual too fast. But they blamed Interior, too, for "surrendering" to these importers and hiking the quotas.

Leaders of the National Coal Association and the National Coal Policy Conference issued strong statements calling for an investigation by Congress or Interior to uncover the "sabotage" of the control program.

The Independent Petroleum Association of America, in a milder statement, also questioned Interior's action in hiking the quotas at this time.

IPAA said residual-fuel inventories on the East and Gulf Coasts were at about the same level as they were at the same time in 1958 and 1957, although a little below last year's April 1 inventory total.

Furthermore, IPAA said, residual prices were still depressed, indicating that there must be no real threat of shortages or this danger would be reflected in higher prices.

The importers, having won their point by getting higher quotas, weren't saying anything last week. However, their position had been made clear earlier by Standard Oil Co. (N. J.) which had pointed out that the original quotas had been set unrealistically low, thereby making shortages inevitable. In other words, Interior itself was largely to blame.

A guessing game . . . To some Washington observers, the real root of the problem was the structure of the residual control plan.

The way the plan is set up, Interior must estimate in advance the likely gap between domestic residual supply and domestic demand, then fill the gap with quotas for imported residual fuel.

Inevitably, pressure and politics get involved in such guessing games.

The pressure was evident last winter when the current quotas were being set. The coal interests were pushing for low residual fuel quotas, and there seems to be little doubt that they had some influence in the final decision.

Gulf Goes to Court to Challenge Setting of

GULF OIL CORP., by filing a court suit last week, is forcing a showdown on the Government's handling of residual fuel oil quotas.

It is likely that some other companies, also unhappy, will take similar action, thereby increasing the pressure on the issue.

Gulf is not challenging the control program as such nor the total amount of residual the Government has allocated for import.

It is contesting the method the Interior Department is using in dividing the total among eligible importers.

Under the present program, an importer's quota is based on his proportion of total residual imports in 1957.

Gulf contends that this inflexibile method freezes the importers to 1957 percentages without regard for changed circumstances. Also, Gulf says it results in two companies out of 35 eligible importers being allocated approximately 46% of the total to be imported, and that three companies—including the two—have been allocated 58%. Gulf claims this is unrealistic and unfair.

The company's complaint, filed with the U. S. District Court of District of Columbia, also declares that the allocation procedure bears no relation to residual fuel oil sales.

It points out that although Gulf had 8.9% of residual fuel oil sales in 1957 (excluding sales to other importers), it has been granted only 0.6% of total residual imports.

Gulf originally was granted an allocation for the January-June period averaging 2,504 bbl. daily. Interior's recent action in increasing the quota for all residual importers lifted the company's total to 2,892 bbl. daily for the remainder of the present period.

Appeal is pending . . . Immediately after getting its original allocation, Gulf filed an appeal with the Oil Import Appeals Board. The case was heard early in February, but the board has not yet ruled.

Gulf filed its suit last week without waiting for the board's decision, apparently feeling that it would be turned down just as were all others on which decisions have been announced thus far.

In Gulf's argument before the board, it contended that the Oil Import Administration had gone beyond the President's instructions as to how allocations should be made.

Gulf pointed out that the President's proclamation did not specify that each company should be restricted to the proportion of residual it imported during 1957. Rather, Gulf argued, the President specified that "a fair and

And politics always looms in the background because Interior is keenly aware of the repercussions that would result should a shortage of residual fuel develop, or should prices rise as a result of Interior's restrictive action on resid imports.

By contrast, the crude oil import program is much less susceptible to a political tug of war. This stems from the fact that crude-oil imports are based primarily on a percentage of refinery runs and thereby have some built-in flexibility.

Furthermore, there is no danger of a crude-oil shortage developing during an allocation period because domestic production could easily be stepped up to fill the gap. With residual fuel, greater domestic output is not readily available, economically, so any difference between domestic supply and demand must be met with imports.

Interior officials are keenly aware of the basic weakness of the residual control program, but haven't been able to develop a more feasible approach.

The only move they have made thus far is to announce that after the current 6-month allocation period ends, residual import quotas will be put on a 3-month basis. The hope is that a shorter allocation period will give them some flexibility in dealing with unusual weather or other factors threatening to upset the supply-demand balance.

Obviously, the residual program presents some knotty problems. Just as obviously, unless there is some solution, there will be recurring controversies.

Resid Quotas

equitable distribution" of products be made among companies which were importing products in 1957.

Gulf feels that Interior's yardstick has not been fair and equitable.

It had been known for some time that Gulf was highly discontent with the control program and that it was considering a court challenge. However, it apparently decided that before taking the matter to the courts it should go through the appeals procedure set up by Interior Department. In this fashion, it could tell the court it had exhausted all administrative procedures.

It isn't likely that Gulf's action will have any immediate effect on the control plan. However, it might cause Interior to give the problem further consideration, especially in trying to find a suitable substitute for the present allocation method.

watching WASHINGTON

Clyde La Motte

• The case of the fouled-up resid quotas . . .

THE RESIDUAL fuel import plan has been booted around so vigorously it is taking on the appearance of a football—a political football, that is.

The vacillation of top Interior Department brass, trying to keep first one side then another happy, certainly hasn't helped alleviate the growing suspicion that some of Interior's moves have been based on pure politics rather than realism or fair play.

Consider this sequence of events:

When the current 6-month quotas were being set initially late last year, considerable pressure was applied to Interior, particularly by the coal interests, to keep resid quotas low.

Apparently as a result, the Oil Import Administration recommended a figure which was well below the demand estimate by the Bureau of Mines. The OIA reasoning was this: It would be better to be on the low side than on the high side because it would be easier to adjust quotas upward if necessary to meet demand than it would be to trim quotas during the period to avoid too much supply.

This gap between supply and demand was widened, however, when Under Secretary Elmer Bennett made a further slash in the quotas just before the 6-month allowables were announced. By setting the total import quotas at 425,000 bbl. daily, Bennett was close to 75,000 bbl. daily below Bureau of Mines forecast figures.

This action had the desired effect of quieting the coal boys, but it only delayed the day of final reckoning.

• Who was guilty of 'irresponsible action'? . . .

IT BECAME apparent during January and February that some of the principal residual importers were going to exhaust their quotas long before the 6-month period would be up.

OIA officials, watching the situation closely, warned top Interior officials that a shortage was looming, and urged that steps be taken to increase quotas.

But Bennett delayed, and continued to pacify the coal interests with statements that there appeared to be no justificaion for an increase at this time.

At this point, Standard Oil Co. (N. J.) entered the picture with a letter to the Secretary of Interior citing figures to support its argument that a shortage would develop unless quotas were hiked.

Bennett replied sharply, charging that there was nothing basically wrong with the original quotas but that some importers had shown irresponsible action in bringing in residual fuel too fast.

As late as 4:30 p.m. April 8 he was repeating this charge to a reporter. The very next morning, however, Interior announced an increase in residual fuel oil quotas (see page 90).

• An invitation to more "irresponsibility" . . .

THERE WAS this added touch of irony, too: Despite Bennett's talk of "irresponsible action," the increase in quotas applies to all companies alike. That is, there is no penalty for the "irresponsible" firms, nor is there any reward for those companies which had been trying to stretch their 6-month quotas over the entire 6 months.

It seems a little strange, though, that Interior would be charging the companies with "irresponsible" action when it is Interior—and not the companies—which is responsible for the operation of the program. Thus, if something is amiss, it is up to Interior to straighten it out—or be guilty of "irresponsible" action itself.

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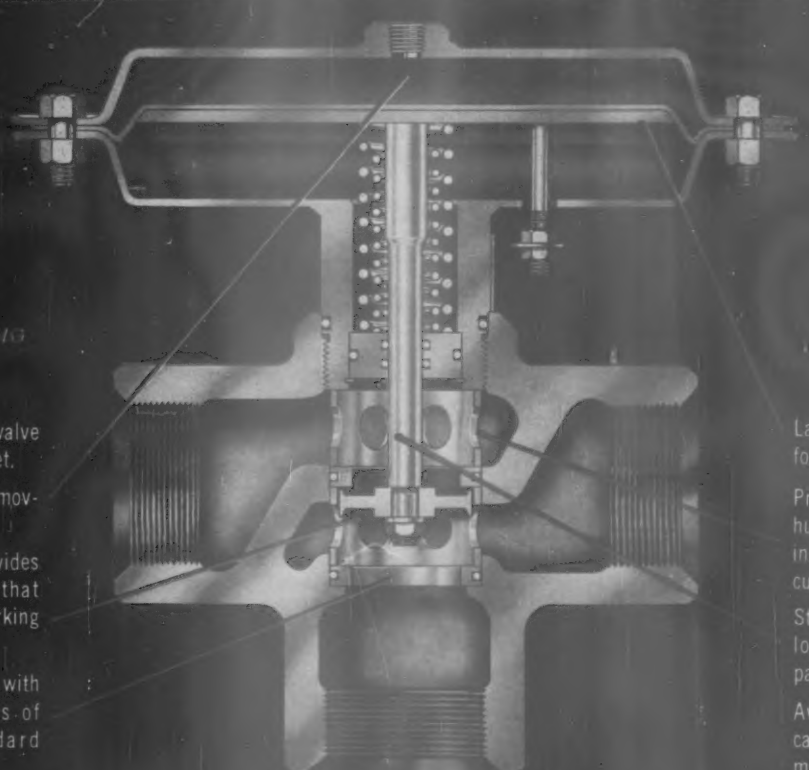

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Consult your nearby Garrett sales and service office for an economical solution to your control valve requirements . . . or write direct.

Canada's "Cardium Alley" Gets Oil Play

- Summer drilling to boost the rig count in Alberta's Carstairs area.

ALBERTA'S Carstairs area northwest of Calgary is due to become one of the busiest oil and gas districts in Western Canada this spring.

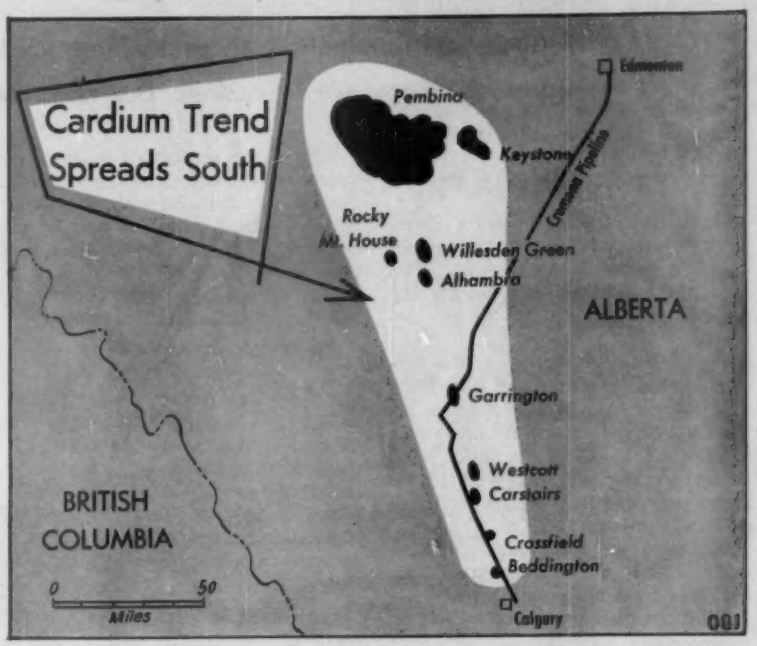
Operators have dubbed it "Cardium Alley" because of recent discoveries in Cardium Cretaceous rocks. The Cardium oil strikes and gas finds in Mississippian and Devonian make it one of the most attractive hunting grounds in southwestern Alberta.

Although production in the Carstairs area is from three pays, the Cardium play is the big story.

The Cardium was unknown until Pembina. It then spread to Keystone, Rocky Mountain House, Willesden Green, Alhambra, and Garrington.

Now, Cardium production has moved 160 miles southeast of Pembina to the gates of Calgary.

The latest Cardium oil discoveries have been by Canadian Superior-Home Oil Co. 8-31 Westcott; Cree Oil of Canada-Canadian Export Gas & Oil team 6-2 Carstairs in Carstairs field; Shell Oil Co. in the Crossfield area; and Western et al. 8-34 Beddington, 5 miles north of Calgary.



There are now eight Cardium oilers in Westcott field, five at Carstairs, one in Crossfield, and one at Beddington. All of the fields south of Garrington are along the Cremona Oil Pipeline.

Nine rigs are now working along the trend, and summer drilling will pull in more rigs in a few weeks to make the area a beehive of development work.

PIPELINE BRIEFS . . .

A decision against participating in a proposed 1,300-mile 16-in. LPG line from Alberta to the Chicago area has been made by Standard Oil Co. (Ind.). Pembina Pipe Line, Calgary, is pushing a plan for a $150-million pipeline to transport surplus product available from plants which will process natural gas for U. S. export (OGJ, April 1, p. 83). Pembina announced that Indiana Standard had participated in studies of the project. Indiana confirmed it had considered a proposal to take part in such a project and had rejected it.

Continental Pipe Line Co. and Husky Oil Co. will build jointly a 6-in. 85-mile products line from Helena to Great Falls, Mont. The line will connect at Helena with the Yellowstone Pipe Line Co. system. Yellowstone's 10-in. line from Billings to Spokane, Wash., is owned by Continental, Husky, Interstate Oil Pipe Line, and Union Oil. The project will start June 1 and be completed by September 1.

A $5-million outlay on distribution systems in British Columbia is planned by Inland Natural Gas Co. Inland will seek franchises and provincial approval to serve Fernie, West Fernie, Cranbrook, Kimberley, Chapman Camp, Maysville, and Creston with gas supplied by Westcoast Transmission Co.

Wages of journeymen pipeline welders will increase 15 cents an hour May 1, 1960, and another 15 cents 1 year later under an agreement concluded by the union and the Pipe Line Contractors Association's labor committee. Welders' rates range from $3.55 hourly in Alabama to $4 in California under the current national agreement. Rates for welder helpers or apprentices will remain at 15 cents above the negotiated common labor rate; the minimum apprentice rate will go up 5 cents May 1 and 5 cents a year later.

A 104-mile 12-in. line planned by Niagara Mohawk Power Corp., Syracuse, N. Y., from Watertown to Massena, N. Y., is scheduled for completion next November. The company also plans a 22-mile 6-in. line from Massena to Malone and a 17-mile 6-in. line from Watertown to Carthage.

Also for Pipeliners . . .

IN THE NEWS: Phillips suggests a method for settling its 12-year-old case before FPC (p. 77) . . . Bavarian pipeline fight to get special study from the government (p. 102).

A complete list of pipeline projects is carried in the last issue of each month. Current projects are covered in Pipeline Briefs.

PLUS THESE TECHNICAL REPORTS: Lab studies shed light on compressor-cylinder cooling (p. 138) . . . Polyethylene pipe means low-cost jobs (p. 143).

Process Control Computers Click

• Successful automation of a pilot plant and two full-scale applications are reported. There are limitations, but not in the computers.

PILOT-PLANT automation is rapidly developing into a major research tool.

A year ago the big question among research men was whether pilot plants could be automated effectively. This year, the question is how quickly and to what extent pilot plants can be automated.

Industry representatives at the Second Annual Symposium on Pilot Plant Automation held in Los Angeles believe use of process-control computers in pilot plants will take a major jump in the coming year. At least 10 refiners indicated they are on the verge of getting into the field.

Although the technique is proving itself, and is pretty well established, limitations are beginning to pop up—not in the computers but in related equipment.

Two refiners reported on successful uses of process computers, one in a pilot plant and the other in a full-scale application.

Catalyst testing . . . Esso Research & Engineering Co. has operated a completely automated catalyst-testing pilot plant at its labs in Florham Park, N. J.

The system, developed and designed by Consolidated Systems Corp., uses a Royal McBee LGP-30 computer. It operates the plant, prints out both process and analytical data, and calculates results at the end of each run.

Some of the results:

. . . A test program showed the system was capable of better than 1% material balance on both oil and regeneration cycles, despite a liquid-feed rate of only 150 to 920 cc an hour. This was greater accuracy than non-automated pilot plants have been able to achieve despite years of development.

. . . Equipment reliability was satisfactory. Experience showed a separate motor-generator power supply with a flywheel may have to be installed to prevent problems caused by failures and switching transients in the public utility supplied power used.

Natural-gas cracking . . . Phillips Chemical Co. last September installed a general purpose digital computer to control a natural-gas cracking furnace at its Sweeny, Tex., ethylene plant. It is being used on a furnace where gas liquids are converted to ethylene.

Although a number of parallel furnaces are operated in the unit, the on-line digital computer, with closed-loop control, is being tested on only one of the thermal furnaces. Tests, however, indicated it could be permanently installed to include all the units using just the one computer.

Phillips' experience showed:

. . . Up-to-date operating data provided by the computer permitted at least a 10% increase in the charge rate to the furnace. Once the computer-inspired increase was achieved, it could be maintained without further computer help. However, for assured maximum increased throughput, the computer must be on-line 24 hours a day.

. . . Results indicate that process set points can be adjusted automatically in a stable, closed-loop computer control set-up.

The Phillips system utilized an Autonetics installed Recomp computer in conjunction with a Phillips-built 30-channel data scanner. The scanner converted analog signals from measuring elements in the cracking process to digital signals acceptable to the computer.

The computer calculated furnace operating conditions and yields from the up-to-date process data. Most of this information could not be obtained by other measurements in a reasonable length of time. These values were compared with desired operating conditions and yields. The computer then calculated and printed out a new set of guides, which the operator used in bringing operations to the proper level. Measurements of temperature, pressure, and flow were sampled in sequence on demand from the computer.

Phillips developed the mathematical model for the process and performed the major part of the computer programing. Autonetics aided in hooking up the hardware and in the coding and programing.

Vinyl chloride . . . Also discussed was a Thompson-Ramo-Wooldridge Products Co. RW-300 digital control computer installation on a vinyl chloride monomer plant at B. F. Goodrich Chemical Co.'s Calvert City, Ky., facility.

The system has been so successful, a Goodrich spokesman said, that the company plans to extend it to logging and control of an adjacent acrylonitrile plant. They'll be able to do this without additional equipment.

Experience showed the system will probably pay out in 3 to 4 years on the vinyl plant, alone, with substantial added economic benefits when it is used to control the acrylonitrile plant also.

State of the art . . . Talks in other phases of the symposium, sponsored by Consolidated Systems Corp., Thompson-Ramo-Wooldridge Products Co., and Daystron, Inc., brought out these general opinions about the state of the art at this time:

. . . Economics. Payouts on automated pilot plants will come from several angles. They're expected to speed development of commercial processing practices, permit more work without an increase in personnel, cut down on trial-and-error methods in reaching optimum performance, and lead to better plant design.

. . . Limitations. Several factors are beginning to show up which tend to limit the full effectiveness of process-control computers in both pilot and commercial plants. For one, concepts of computer uses have outrun achievements. As one symposium panelist put it "the dreaming is ahead of the doing."

Also, there still aren't enough men trained to take full advantage of the talents of the computers.

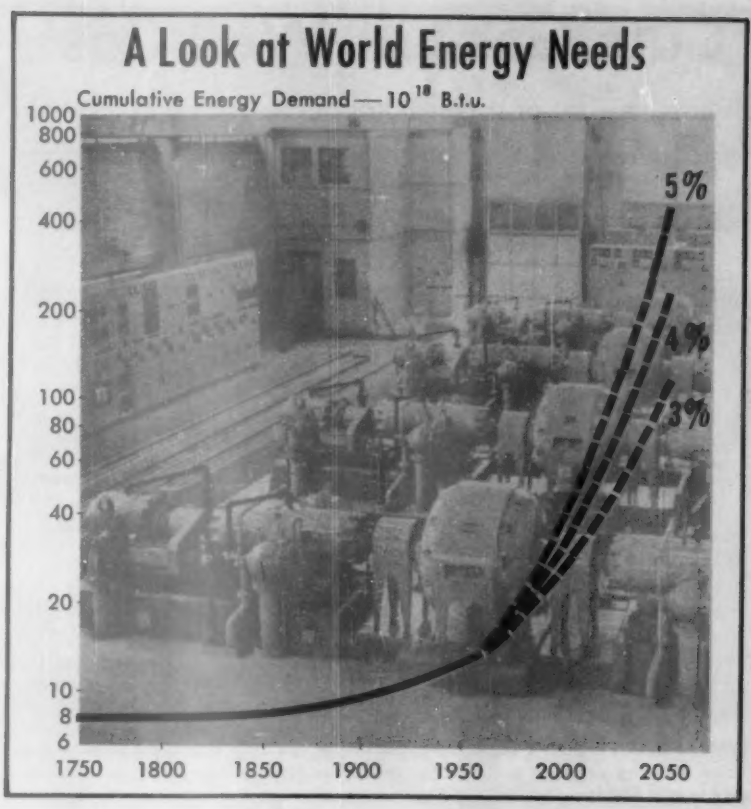
Sensing devices or transducers will have to be improved, particularly for pilot-plant installations.

What's ahead . . . Computer designers and users represented at the meeting agreed these trends are under way in the art:

. . . Bigger and faster computers will be built as use of general purpose computers in process-control systems grows.

. . . Smaller, special purpose computers (digital, analog, or hybrid) will be developed to handle small control problems as they crop up in actual experience.

. . . Increased use of process control computers will force development of special transducers and analyzers. Existing process chromatographs are doing an outstanding job thus far.



Energy Demand to Soar

. . . as the world's population more than doubles in the next 40 years, Sinclair Research official tells PIEA.

THE OIL INDUSTRY, now plagued by surplus, will need the help of other energy sources to meet future world demand.

Principal factor in this demand growth is the world's exploding population. This has had, and will continue to have, the effect of annually compounding the demand for energy.

Present world population is about 2.8 billion. But the Petroleum Industry Electrical Assoication last week was told world population will total between 6 and 7 billion in the year 2000 and may top 10 billion by 2050.

Addressing the association's meeting in Kansas City, W. H. Decker, of Sinclair Research Laboratories, said annual energy demand may soon exceed the total amount consumed by the world up to 1750 A.D., and it will continue to climb.

Fuel reserve estimates vary widely, but it is realistic, Decker said, to conclude that exhaustion of fossil fuels is a definite reality and other sources of energy must be developed.

Several of the more significant developments in the fields of energy sources and conversion devices were reviewed by Decker. They include:

. . . Nuclear energy. The importance of the nuclear reaction for energy production can be seen from the fact that approximately 10,000,000 k.w.h. of energy are released per pound of fissioned uranium 235.

The fission reactor has, however, provided an additional potential source of energy that is tremendously significant. The fissioning of 235 liberates an average of two high-energy neutrons. One of these is consumed in maintaining the chain reaction, but the other can be used to form new fissionable materials.

It has been estimated, he said, that with further advances in both breeder reactor design and recovery of thorium and uranium the supply of energy from nuclear fuels will be extended for thousands of years.

. . . Fuel cells. Active study is under way on five fuel cells. He typed them as the hydrogen-oxygen fuel cell, the ion exchange cell, the molten salt cell, the Redox cell, and the consumable electrode fuel cell.

The fuel cell is not yet economically competitive and it produces high-current, low-voltage d.c. power, Decker pointed out. AC invertors cut efficiency of the cells.

. . . Thermoelectric generator. These units probably will not be directly competitive with large power plants but their simplicity and size lend them to specialty applications.

. . . Other sources. At present, Decker said, thermionic converters have efficiencies in the range of only 5 to 10%. And a probable maximum efficiency of about 30% is visualized.

A solar device, the photo-voltaic cell, also has low efficiencies.

Third Flood Planned in Oklahoma Field

EOLA FIELD in Garvin County, Oklahoma, is due to become the first in the state—and perhaps the first anywhere—that has three water floods operating in three different reservoirs under three separate unitization agreements.

Pan American Petroleum Corp. has asked the Oklahoma Corporation Commission to approve the unitization and flooding of the Oil Creek zone in the field's northwest fault block. Two other producing zones in the block have already been approved for flooding. They are the Bromide and the McLish.

There may be another "first" to the credit of Eola and Pan Am. These flooded formations are believed to be the deepest in operation. Depths of the three formations range from 10,000 to 11,000 ft.

Discovery well for the fault block was completed in the Bromide and McLish in May 1953 and in the Oil Creek in March 1955.

Pan Am engineers have found that the oil in the three zones has a high shrinkage factor. With the reservoir energy coming from a solution gas drive, pressure decline will be rapid, and a lot of oil will be left behind due to shrinkage.

Pressure will be maintained initially with only water injection, but a crestal gas injection program is planned for the McLish Unit at a later date. The Oil Creek may possibly have gas injection also.

New Method Cuts Gas-Lift Well Costs

• Garrett Oil Tools says new set of curves it has developed using only four variables gives engineers a shortcut to peak efficiency in gas-lift operations.

A SHORT-CUT to the most efficient method of operating a gas-lift well was unveiled in Dallas last week by Garrett Oil Tools, Longview, Tex.

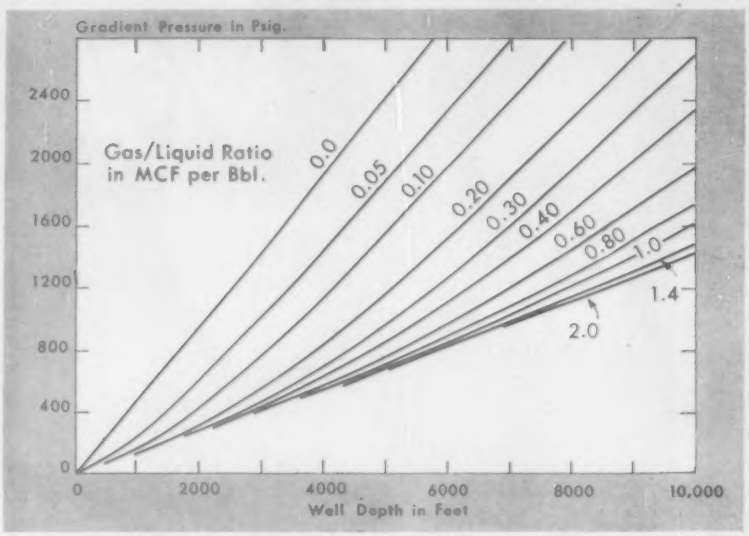
Garrett terms its new Opti-Flow process a "great technological breakthrough" and says it is the result of 6 years of research by company engineers using electronic computers.

Two years of field tests have proved that the concept will effect large savings in initial compressor horsepower and in over-all operating costs, Garrett says.

Savings in production costs, it says, have ranged as high as 75% in single wells.

Until now, Garrett engineers say, locating gas-lift valves, and selection of depth and pressure for gas injection have been more of an art than a science. In most cases, it took too much time and too complicated a procedure to really engineer the job.

Garrett has developed master curves which, it says, can be aplied to "nearly every well and production situation." Using these curves, it says, an engineer in a few minutes can calculate a well's optimum efficiency and design his job to achieve it.



TYPICAL MASTER CURVE shows relationships of the four significant gas-lift variables. Flowing pressure gradient for this curve is based on 100% water. Flow rate is 600 bbl. per day in 2.375-in. tubing. Gas specific gravity is 0.65; water specific gravity is 1.074, and average flowing temperature is 150° F.

How it came about . . . Garrett engineers attribute their "breakthrough" to a discovery that they could discard as not significant most of the 12 variables formerly used to calculate flowing gradients for oil wells.

These include: Tubing size, rate of liquid flow, gas-liquid ratio, flowing well-head back pressure, liquid composition, flowing friction factor, compressibility factor of gas, average flowing temperature, gas gravity, liquid gravity, gas-liquid solubility, and formation volume factor.

Garrett's study showed, it said, that of all these variables only four were significant: Tubing size, rate of liquid flow, gas-liquid ratio, and flowing well-head back pressure.

It found that all others could be used as constants under the conditions known during calculation without impairing the accuracy of the calculations from a practical standpoint.

Reducing the significant variables to four permitted Garrett engineers to present them in chart form as a family of gas-liquid ratio curves. There is one curve for each rate of liquid flow and tubing size, indexed to zero flowing pressure.

They are plotted as a depth-pressure relationship for 100% water and 100% oil. A curve, when properly corrected for well-head back pressure, becomes the required flowing gradient.

The most significant change between the old method and the new shortcut route, Garrett says, is that flowing pressure gradients in vertical pipe are no longer anticipated in terms of pounds per square inch per foot.

What it does . . . Use of the Opti-Flow design technique for gas-lift installations permits the operator to attain optimum well performance for any given set of operating conditions.

He can calculate the correct spacing of valves to unload to and maintain the most efficient point of injection.

It permits the operator to answer quickly such essential gas-lift questions as:

. . . How deep and at what pressure should the gas be injected for maximum return with minimum compressor horsepower?

. . . What effect does existing well-head back pressure have on the design of the well?

. . . What tubing size will produce the well at the desired rate?

. . . How can you get full operating pressure to the point of injection without excessive loss on deep wells?

Results in dollars . . . Garrett has a basketful of case histories compiled during the past 2 years where it has been able to save operators big money.

On one 10-well lease, use of the curves saved the operator $216,000 on initial horsepower requirements and $70,080 in annual operating costs through evaluating the effect of well-head back pressures.

On another of the same size, the curves, when used to evaluate proper injection pressure, saved $103,500 in compressor horsepower and $58,100 in annual operating costs.

On a third, savings of $157,000 in initial compressor horsepower costs and $65,250 in annual operating costs were made when the curves were applied to utilize full available operating pressure.

These, Garrett contends, are average case histories—not the best.

Taylor Milton, Garrett president, said seminars will be held in Houston, New Orleans, Tulsa, Midland, Denver, Los Angeles, Corpus Christi, and New York to explain the technique.

An advanced school for senior engineers and another school for field engineers will be held later, he said.

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. . . for sale or lease

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- Only two basic cleaning heads required for all pipe sizes from 16" through 36".
- Retractable brush unit minimizes pipe entry damage. Pressure of high speed circular wire brush indicated on operator's console — for easy adjustment during operation.
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- Operator controls machine operation from centralized push button console . . . he does not have to ride boom car.

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Canadian Gas-Processing Plans Under Way

CONSTRUCTION of 23 processing plants in Alberta has been proposed to handle natural gas which will be exported to the U. S.

The export of 6,529 billion cubic feet over a 25-year period was recently approved by the Canadian Government (OGJ, Apr. 11, p. 83).

There are 15 natural-gas processing plants in operation which serve export pipelines. Two are being built.

The plants being built are a $12,500,000 British American Oil Co., Ltd., plant at Homeglen-Rimbey and a $3,000,000 Canadian Oil Companies, Ltd., plant at Innisfail.

Locations for the proposed plants are: Berland River, Brazeau River, Burnt Timber, Calgary North, Carson Creek, Savanna Creek, Crossfield, Gilby, Harmattan, Harmattan Elkton, Kaybob, Lookout Butte, Olds, Pembina, Pine Coulee, Sarcee, Stolberg, Sylvan Lake, Waterton, Wildcat Hills, Wimborne, Windfall, and Worsley.

Both of the plants under construction will furnish gas to Alberta & Southern Gas Co., Ltd. The company's export permit covers the delivery of 3,826 billion cubic feet. This project, which would serve the San Francisco area, still needs Federal Power Commission approval.

Gas suppliers . . . About 10 companies will supply the major portion of Alberta & Southern's exports. The producers are: Shell Oil Co. of Canada, Ltd.; British American; Hudson's Bay Oil & Gas Co., Ltd.; Pan American Petroleum Corp.; California Standard Co.; Texaco Exploration Co.; Canadian Fina Oil, Ltd. (Calvan & Western leaseholds); Mobil Oil of Canada, Ltd.; Sun Oil Co.; and Imperial Oil Ltd.

Alberta & Southern has a total of 100 gas purchase contracts and options with 49 producing companies.

Trans-Canada Pipe Lines, Ltd., the only new permit holder which has FPC approval of its project, has signed long-term contracts with 56 separate gas producers in Alberta.

Estimated value of sales by the 10 top suppliers to Trans-Canada for the 1962-63 heating season are:

British American, $9,540,061; Canadian Delhi Oil, Ltd., $3,452,152; California Standard, $3,188,906; Hudson's Bay, $2,923,690; Canex Gas, Ltd., $2,585,294; Provo Gas Producers, Ltd., $2,289,454; Tennessee Gas Transmission Co., $2,105,272; Home Oil Co., Ltd., $1,997,118; Canadian Superior Oil of California, Ltd., $1,005,226; Saskatchewan Power Corp., $943,681; and Mobil, $906,344.

Independent Refiner Buying Production

CLARK Oil & Refining Corp., an independent refiner and marketer, will become an integrated company through the purchase of Intex Oil Co., a Bakersfield, Calif., producing and exploration firm.

Intex has an annual crude production of about 1 million barrels. The company operates in California, Texas, New Mexico, Colorado, and Utah.

The acquisition will provide a portion of Clark's crude-oil requirements and give the company a production and exploration division. Clark, which headquarters in Milwaukee, has two refineries, one in Chicago and the other in New Orleans. It markets in nine states.

The proposed merger is subject to the approval of the boards of the companies and a majority of the shareholders of Intex. Clark is expected to offer one share of common stock, one share of preferred ($15 par value), and one share of preferred stock ($18 par value) for each five shares of the outstanding common stock of Intex.

PROCESSING BRIEFS . . .

Construction of a $1½-million carbon monoxide boiler has started at the Standard of Ohio refinery at Lima, Ohio. Completion will be in December. The boiler will reduce fuel costs and increase steam production potential. Savings will come by burning carbon monoxide and recovering heat from flue gas from the catalytic cracking unit.

A new gasoline, containing a component (MS-3) that helps prevent the formation of gums and other harmful deposits in the carburetor and fuel system, has been introduced in the West by Tidewater.

A $1,900,000 modernization program is under way at three Warren Petroleum plants. Electrical and steam generating units being installed at the Monument, N. M., plant will increase propane production 20,000 gal. daily. Capacity of the McLean, Tex., plant is being increased 15,000 gal. daily, and new facilities at the Fostoria plant in Montgomery County, Texas, will increase deethanized gasoline production 45,000 gal. daily.

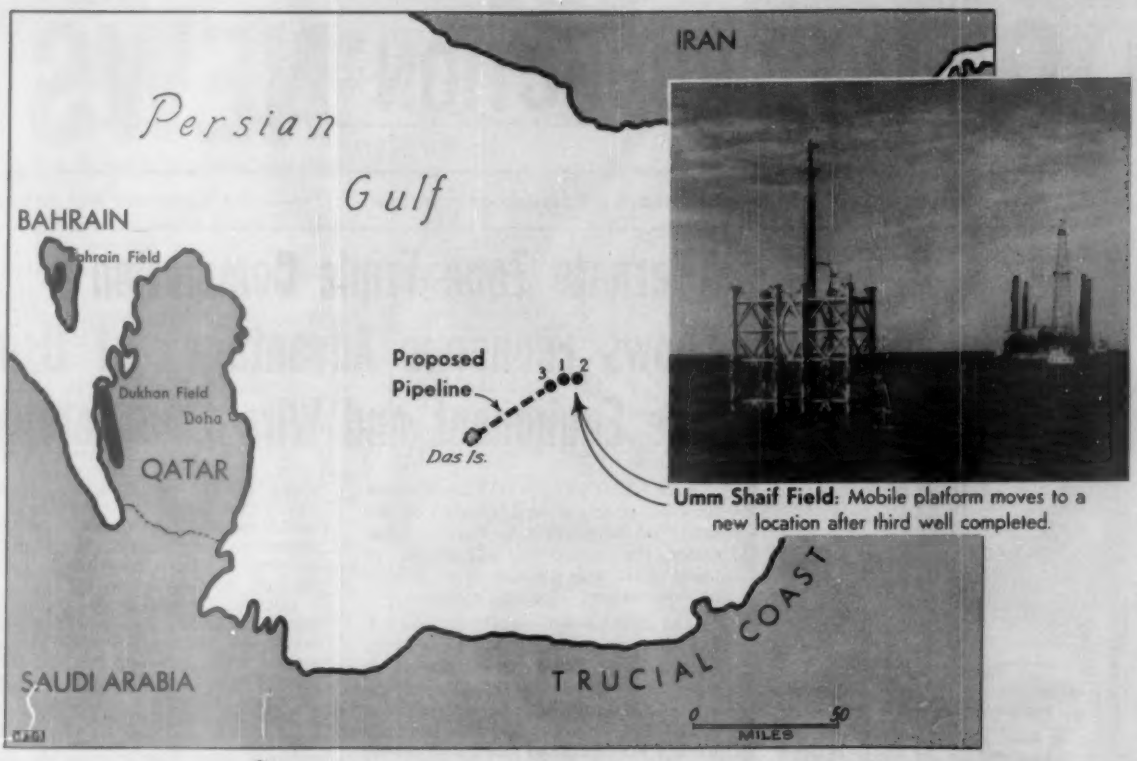
Butadiene production facilities at the Copolymer Rubber & Chemical Co. plant, Baton Rouge, will be increased 50% in a $5-million expansion program. Work starts in July and will be completed in May 1961. Foster Wheeler is contractor.

Ashland Oil & Refining Co. will increase by 25% the size of its proposed commercial hydrodealkylation plant. It also plans to build the Hydeal plant at its Catlettsburg, Ky., refinery instead of Buffalo, N. Y., where it was originally planned. The unit will have a capacity of about 75 million pounds a year of naphthalene and 15 million gallons of benzene. The change in size was dictated by growing demand for the two products. The plant is to be completed by next March 1.

Also for Refiners . . .

IN THE NEWS: Restraint now in refinery runs and crude production may mean the difference between a good or poor last half for oil (p. 75) . . . Weakness of crude prices shown in price cuts for four areas (p. 79) . . . Imports pot continues to boil as Gulf challenges resid quotas in court suit (p. 90) . . . Successful automation of a pilot plant and two full scale applications of computers reported (p. 94) . . . Building of 23 processing plants proposed in Alberta to handle gas scheduled for export to U. S. (p. 98).

PLUS THIS TECHNICAL REPORT: Unicracking upgrades marginal cracking stocks (p. 104).



Umm Shaif Field: Mobile platform moves to a new location after third well completed.

Das Island: New Source of Middle East Oil

- **Submarine line will move crude from Umm Shaif field to the island, where tanker terminal will be built.**

A YOUNG offshore oil field in a remote corner of the Persian Gulf is due for full-scale development.

Umm Shaif structure, some 70 miles off the Trucial Coast, is considered sufficiently proven after three wells to set plans in motion for the Middle East's newest offtake and tanker terminal system. A 20-mile submarine line will be built to tiny Das Island, where gas/oil separators, a tank farm, and a tanker loading jetty will be built. The project will take about 2 years to complete.

Abu Dhabi Marine Areas, Ltd., owned two-thirds by British Petroleum Co., and one-third by Cie. Francaise des Petroles, shifted from an exploration to a development program only 2 years after spudding its first offshore wildcat from a drilling barge northeast of Das Island. All three wells drilled have been completed as producers, even though the second is considered disappointing. The fourth well now being drilled by "ADMA Enterprise" is a development well.

The first well encountered oil in the Thamama formation at about 5,500 ft. On initial tests it flowed 2,400 bbl. daily of 40°-gravity crude, with a low sulfur content of about 1.4%. The Thamama, a Lower Cretaceous sandstone horizon, is one of the productive zones in Saudi Arabia's offshore Safaniya field.

The second well, while it found oil, was disappointing as a producer. Umm Shaif 3, however, was completed after hitting the Araej Zone at about 9,600 ft. After tests of the well, the go-ahead was given for a full-fledged commercial development. Details of the tests have not been revealed.

The Continental Shelf slopes gradually downward from the Trucial Coast. Subsurface exploration by J. Y. Cousteau and a company geologist showed the bottom was similar to the shore, with rolling contours, broken by an occasion cliff or cave. The first three drilling locations were staked before the DeLong barge was ordered.

The offshore concession covers 12,000 sq. miles. Rights obtained from the trucial shaikhdom of Abu Dhabi 7 years ago have another 58 years to run. While BP is the biggest crude producer in the Middle East, with 40% of output in Iran, 50% in Kuwait, and 23¾% in the Iraq Petroleum Co. group, Umm Shaif will be the only production at the present time not shared with an American partner.

Das Island . . . The new tanker terminal will be built at a location desolate even for the Middle East.

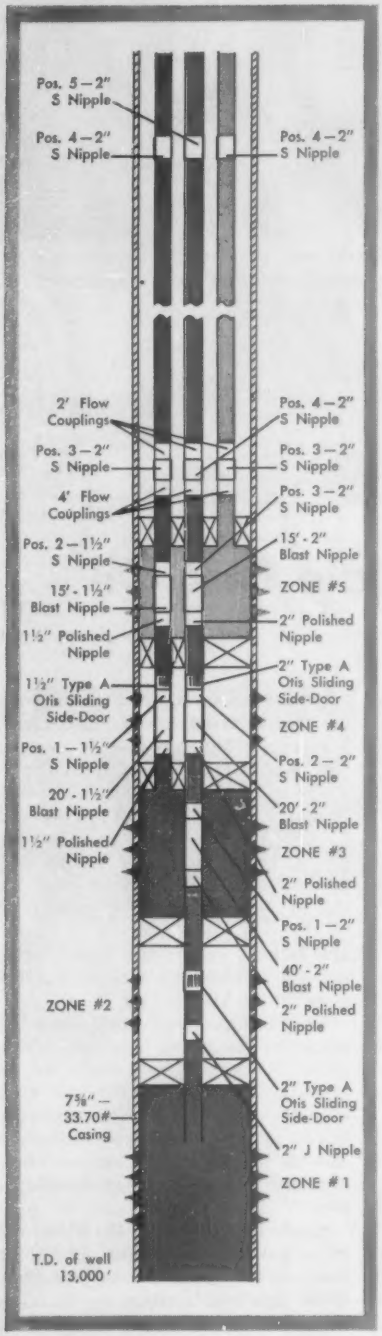
Das Island, which lies about 50 miles off the coast, was uninhabited until it became a base camp for the offshore exploration program. It is only 1¼ mile long and ¾ mile wide. But its saving graces are a flat surface, suitable for an airstrip, and an abundance of rock, useful in building a jetty.

Crude exported from the island will have a slight geographic advantage. Tankers berthing there instead of at other terminals further up the Gulf will shave several hundred miles from the round trip to world markets.

SPECIAL REPORT TO MANAGEMENT

OTIS PRODUCTION NEWS

Volume II, Number 1 **Otis Engineering Corporation • Dallas** *Production Equipment and Services*


Pos. 5 — 2" S Nipple
Pos. 4 — 2" S Nipple
Pos. 4 — 2" S Nipple
2' Flow Couplings
Pos. 4 — 2" S Nipple
Pos. 3 — 2" S Nipple
Pos. 3 — 2" S Nipple
4' Flow Couplings
Pos. 3 — 2" S Nipple
Pos. 2 — 1½" S Nipple
15' - 2" Blast Nipple
ZONE #5
15' - 1½" Blast Nipple
2" Polished Nipple
1½" Polished Nipple
2" Type A Otis Sliding Side-Door
1½" Type A Otis Sliding Side-Door
ZONE #4
Pos. 1 — 1½" S Nipple
Pos. 2 — 2" S Nipple
20' - 1½" Blast Nipple
20' - 2" Blast Nipple
1½" Polished Nipple
ZONE #3
2" Polished Nipple
Pos. 1 — 2" S Nipple
40' - 2" Blast Nipple
ZONE #2
2" Polished Nipple
2" Type A Otis Sliding Side-Door
7⅝" — 33.70# Casing
2" J Nipple
ZONE #1
T.D. of well 13,000'

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Alternate Zone Triple Completion Shows Economic Advantages of Using Otis Equipment and Wire Line Services

LAFAYETTE — This offshore, multiple-zone gas well, located off the coast of Southern Louisiana, illustrates the economic advantages of using Otis sub-surface flow control equipment and wire line services.

The cost of the installation, including the tubing safety valves, sleeves, nipples, and other Otis sub-surface equipment as shown in the accompanying diagram, totaled slightly under $12,000 — or about $65,000 less than what it would cost to move a workover rig onto the well to deepen it and recomplete the lower zones, had the well been drilled and completed differently. As equipped, this well can be produced until all five zones have been depleted, with only occasional wire line service to permit production from each of the different zones.

T.D. of the well was approximately 13,000 feet with five different zones of potential production below 12,600 feet. When called to engineer the completion, Otis specialists were asked to design an installation that would permit alternate production of three of the zones through the long string and one through each of the other strings, or two zones through the long string and two through the intermediate string, with the top zone to be produced through the short string.

Two single packers were used to isolate zones 1 and 2 and a Type A Otis Sliding Side-Door and Type J Otis Landing Nipple made up in the tubing between the two packers. This arrangement will permit the bottom zone to be produced first through the long string, and then zone 2 by setting a Type PJ Otis Plug Choke in the landing nipple and shifting the sleeve in the Sliding Side-Door. The Type PJ choke is designed to hold pressure from either direction.

A blast nipple with a Position 1 Type S Otis Landing Nipple above and a polished nipple below was designed into the long string opposite zone 3. This is the zone to be produced through the intermediate string. In the event flow from zone 3 should cut through the blast nipple, the landing nipple and polished nipple will be used to pack off the hole and permit continued production of either of the lower zones through the long string. The landing nipple above the blast nipple may also be used to land a plug choke in the event both lower zones deplete sooner than anticipated and the operator decides to produce zone 4 through the long string.

Otis sliding side-doors were designed into both the intermediate string and the long string between the packers isolating zone 4. This will permit selective production of that zone through either string of tubing. S nipples, blast nipples, and polished nipples were also made up on both the intermediate and long strings opposite zone 4 to provide the tubing with the same protection as described for zone 3.

In that this was a gas well, S nipples with flow couplings above and below were made up in all three strings of tubing, immediately above the top packer, to accommodate Type FS Otis Tubing Safety Valves. This provided Storm Choke protection for each string. By locating the safety valves just above the top packer, the operator will be able to carry on a corrosion inhibitor program without pulling the safety valves. S nipples were also located in each string approximately 1,500 feet from the surface for plugging purposes until gathering lines could be laid.

This Otis-engineered completion was designed to provide the ultimate in economical, versatile, and efficient alternate-zone production. For more information on alternate-zone, multiple completions or for help with any other specific completion problem, call the Otis office nearest you or write Otis, Dept. 1-W, Box 35206, Dallas 35, Tex. Experienced Otis specialists are ready and anxious to provide you with a "packaged" well completion service.

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Caltex Has Inside Track on Big Concession

• Acreage is between big Hassi Messaoud field and the Edjele area. RAP will be French partner in deal.

CALTEX is coming up a winner in a contest for part of the last big open concession acreage in eastern Algeria.

The French Government is about to award rights to the 26,400-sq.-km. Zemoul-el-Akbar tract to a Caltex affiliate and Regie Autonome des Petroles (RAP). The award will put Caltex in the Algerian oil play for the first time.

Caltex bid on the acreage, which covers about 16,600 sq. miles, through Calasiatic-Topco. Terms of the license award to Calasiatic-Topco and RAP apparently will be similar to the grant made in a Jersey Standard-French agreement on a big block adjoining Zemoul-el-Akbar on the northeast. Jersey and its French partners each have 50% interest in the venture.

At least two other American-based companies reportedly were interested in the open concession. These were Pan American International and Franco-Wyoming.

The acreage is among the last opened in the Hassi Messaoud-Edjele section of Algeria. The only other open acreage adjoins the Caltex-RAP nomination to the west. French companies are bidding for this open acreage, but no U. S. companies are involved.

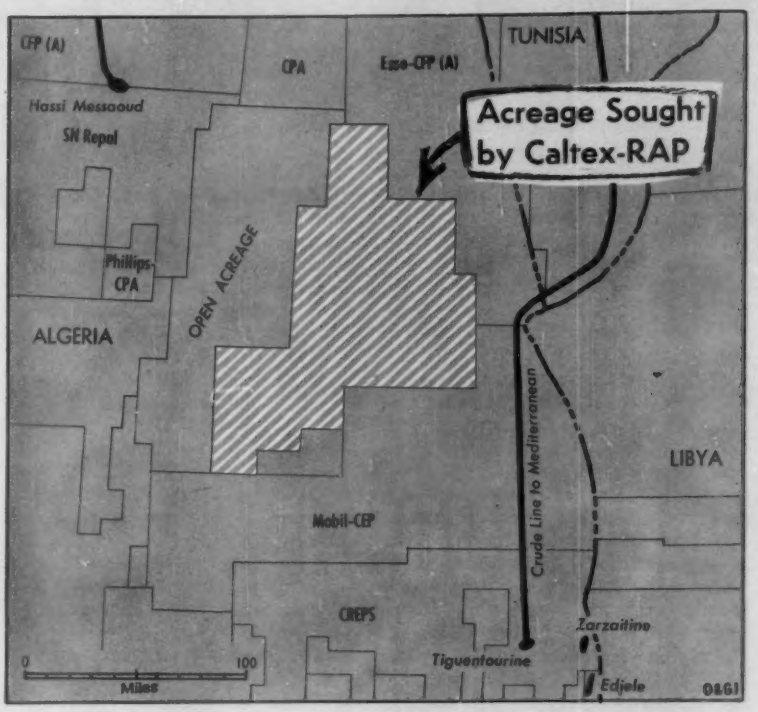
In addition to the Esso program to the northeast, other American companies with interests in the same part of the Sahara include Mobil International, which has 25% interest in four blocks lying on the south, and acquired from CEP and its partners. One of the four Sahara licenses in which Phillips Petroleum has an interest lies about 60 miles west.

Edjele looks up . . . The future of the French Saharan oil area got a shot in the arm last week by a sharp upgrading in the production potential of the already prolific Edjele area and by an impressive stepout well south of Hassi Messaoud.

CREPS, operator in the Edjele concession, has revamped its development program as the result of unexpectedly good production tests at Zarzaitine.

Zarzaitine, which has 54 producers, will open this year with a much higher potential than originally planned, and CREPS has trimmed the total number of wells it plans to drill to meet production goals. Royal Dutch-Shell has 35% interest in the company.

Because the company has more production than expected, the pipeline subsidiary, Trapsa, has decided to start work immediately on a third pumping station on the 460-mile 24-in. pipeline to the Mediterranean.



Libyan Drilling to Increase

THE NUMBER of rigs operating in Libya will triple in the next 18 months.

This prediction was made last week by Howard H. Lester, chief geologist for Texas Gulf Producing Co., which has an interest in 6 million acres in Libya. Lester was speaking at a Houston NOMADS meeting.

Lester says three things will cause the upsurge in Libyan drilling: Two 30-in. crude lines are being built, which will increase development drilling; companies will step up drilling in northern Libya before relinquishing one-fourth of their acreage; and Libya will lease some of the surrendered acreage, which should lead to more exploratory work.

Lester said there were 28 rigs in Libya January 1. This number was increased to 36. He predicts the total will hit 100 within 18 months at the present rate of increase.

There are now seven tanks at In Anemas. About 350 miles of the line has been put in the ground. The system is scheduled to open October 1. Capacity of the line will jump from 144,000 bbl. daily to 190,000 bbl. daily in the spring of 1961 as the result of the stepped-up expansion.

CREPS also found good news in the well at Edjele, the first of the discoveries in the area. Edjele D1-193 produced oil from the Ordovician series for the first time in the field. The test flowed 25 bbl. per hour, and improves the prospects for the southern side of the structure where several dry holes were drilled recently.

El Gassi well . . . SN Repal's El Agreb 2 well flowed 44 bbl. per hour in a test of a 10-ft. section topped at 3,132 meters, or about 10,250 ft. The test was from oil impregnated sandstones in Cambrian. The well is coring.

The well lies on El Gassi structure which overlaps three license areas. El Gassi 1, 50 miles south of Hassi Messaoud, and El Agreb 1, 8 miles southwest of El Gassi, both were completed as producers last year in sandstone below 10,000 ft.

El Gassi 2, however, 6 miles due south of the discovery, was a dry hole. French geologists think a fault lies between the two El Gassi wells, but that the structure is continuous between El Gassi 1 and El Agreb.

Deal to Rework Indonesian Fields Is Made

- Japanese hope to produce 43,000 bbl. daily from old Shell fields. They'll get to keep 12,000 bbl. daily.

THE JAPANESE last week agreed to advance about $52 million in equipment, materials, and manpower to put North Sumatra's oil fields back into full-scale production.

In return the Japanese are guaranteed a minimum of 12,000 bbl. daily of high-gravity crude for at least 10 years.

This Japanese-Indonesian deal to rework the old Royal Dutch-Shell fields has been an off-again-on-again thing for several years. Negotiations on this contract began more than 2 years ago. The deal was signed by Col. Ibnu Sutow, president of Permina, the Indonesian national oil company, and Kiichi Miura, president of Japan Petroleum Exploration Co., a semi-government corporation.

If the governments of Japan and Indonesia approve the contract, it will become effective in June. Then, all the two groups have to worry about is rejuvenating the fields and keeping the Sumatra rebels from sabotaging the whole thing.

Elements of the rebels, still active in the jungles, have warned they won't honor the agreement unless they get a cut. (OGJ, Feb. 15, page 82).

Miura, as head of Japex also represented a privately financed group in Japan headed by Ataru Kobayashi, former head of the Japan Development Bank. Kobayashi's group includes such figures as Shigeru Kinoshita, president of Kinoshita Co., a trading firm, and T. Ishibashi, president of Bridgestone Tire Co., Japan's largest rubber manufacturer.

The agreement . . . The Japanese group will advance Permina 18,845,000,000 yen (about $52,300,000) in machinery, equipment, materials and technical assistance.

As part of the "technical assistance," the Japanese plan to send about 20 Japanese engineers to Sumatra to work on the project.

The Japanese have set a production goal of 2,500,000 kiloliters a year (about 43,000 bbl. daily) by the end of 1964. They expect to maintain or increase this production from the fields for the duration of the contract.

To get their money back, the Japanese will start taking 40% of the oil output over the current 800,000 kiloliters a year (about 13,800 bbl. daily) beginning in 1961. The contract is subject to revision on the amount of the Japanese offtake once the production goal of 43,000 bbl. daily is reached.

Permina has guaranteed only that the oil the Japanese get will at least equal the value of the goods and services they provide.

The fields . . . The fields involved, former properties of the Royal Dutch-Shell Group, were never returned to Shell after World War II.

The best field in the group is Rantau, which produced a peak of about 15,000 bbl. daily in 1939. A few years ago, the field had only 2 wells producing and another 118 shut in. Of the shut-in wells, about 80 were believed to be capable of production once they are cleaned out and reworked.

Other fields, all formerly linked by 5 and 6-in. pipelines are Peureulak, Serandjaja, and Belawan. All served the Pangkalan Brandan refinery also operated by Shell.

Bavarian Pipeline Fight to Get Special Study

BAVARIA has set up a special commission to study rival pipeline proposals for supplying its growing markets.

The unusual move was made to investigate the merits of four separate pipeline systems proposed by competing groups. The lines would supply one, or possibly two, refineries to be built in Bavaria. There is no processing capacity at present in the West German state.

In the face of a variety of offers, the local government wants to get off on the right foot in planning for growth of the oil industry in the area. The government is eager to avoid either over or under expansion. It also wants to avoid the vexing problems caused by the rapid introduction of heating oil in other parts of Germany.

Established German marketers would like to move crude into Bavaria by building a 170-mile spur to the 459-mile big-inch crude line proposed from Marseille to Karlsruhe, West Germany. Local affiliates of Royal Dutch-Shell, Esso, British Petroleum, and the BV-Aral group are involved, and a joint refinery may be built.

One possible location for a refinery is Munich, the center of consumption. But a plant could also be built at Regensburg, which lies near the center of the country, and which is on the Danube River.

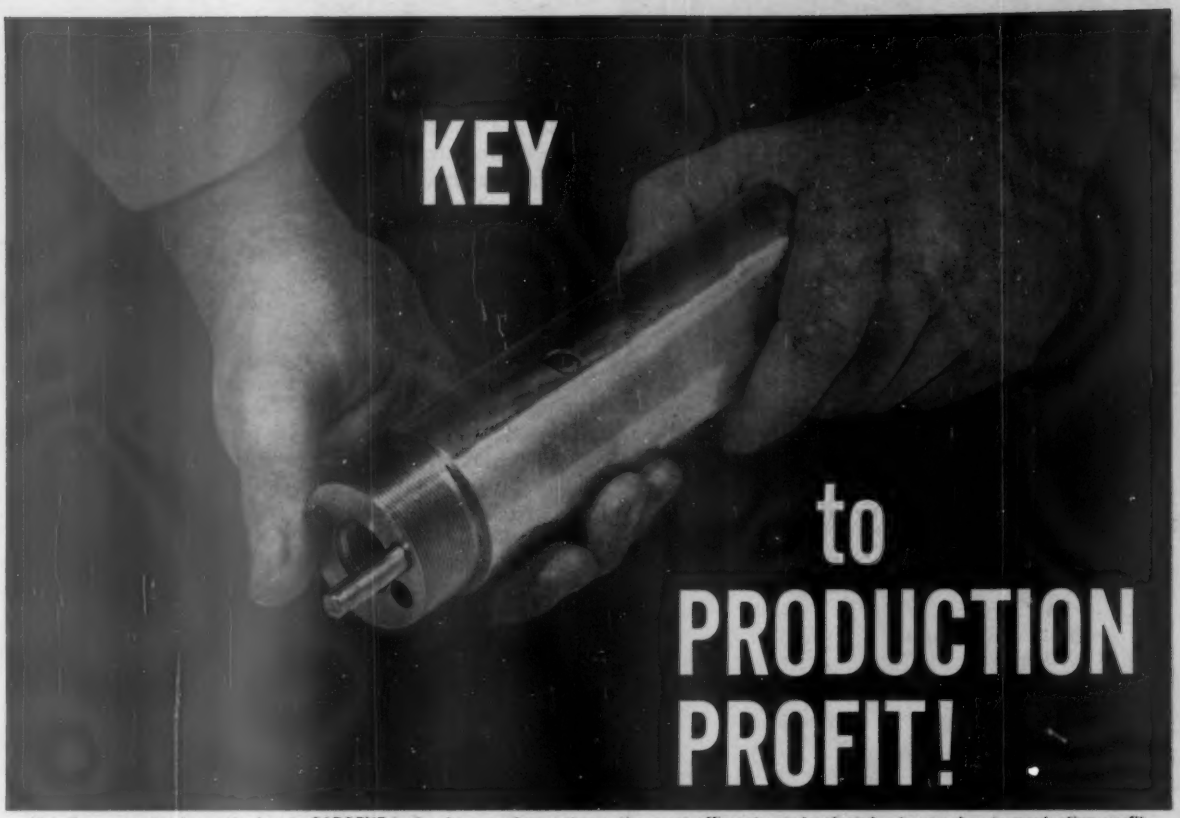
Another project is proposed by Italy's ENI, headed by Enrico Mattei. ENI has under construction a system running northward from Genoa that will supply refiners in northern Italy, and a plant planned at Aigle, Switzerland.

ENI wants to extend the system into Bavaria, where Mattei would like to establish a marketing organization. The pipeline would be supplied with Egyptian crude, or with crude production Italy is seeking to develop in Iran.

While proposals by established companies and by ENI have received the most attention, two other groups also have plans afoot. One of these is for a pipeline directly from Genoa to Bavaria, which would deliver Saudi Arabian crude. Names mentioned in connection with the project are Getty, Hassan Yusseph Yaffin, and possibly German banks.

The other project is for a line running northward from Venice via Austria. This would be built by the Barnabo group, which has a highway under construction over the same route. An advantage of this system might be that some of the crude might be dropped off in Austria, where local output is declining. Venice can also take 50,000-ton tankers, while Genoa is limited to 30,000-ton vessels.

Bavaria has 29% of West Germany's territory, but only 18% of its population, and 15% of the country's domestic consumption, averaging 70,000 bbl. daily. This level is expected to rise to 110,000 bbl. daily by 1965 and to continue to expand rapidly thereafter.



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UNICRACKING

Answer to "Pink-Cloud" Specifications

Process provides new way to upgrade heavy naphthas, middle distillates, and gas oils to high-quality gasoline and middle-distillate products.

UNICRACKING is a new catalytic hydrocracking process developed by Union Oil Co. of California to convert marginal cracking stocks to high-quality gasoline and middle-distillate products.

It provides a way to upgrade catalytic cycle oils; thermal and coker gas oils; heavy cracked or straight-run naphthas; and high-sulfur, high-nitrogen virgin gas oils.

R. C. Hansford, C. P. Reeg, F. C. Wood, and Raoul Vaell, of Union, in a paper presented to the WPRA in San Antonio last month made these points in favor of the process:

Efficiency. It will convert refractory stocks more efficiently than catalytic or thermal cracking. Yield of liquid products is generally about 110 to 120 vol. % of feed.

Flexibility. It can produce gasoline and premium diesel or jet fuels in varying proportions.

No fuel oil. Low-value fuel oil is converted to gasoline and middle distillate.

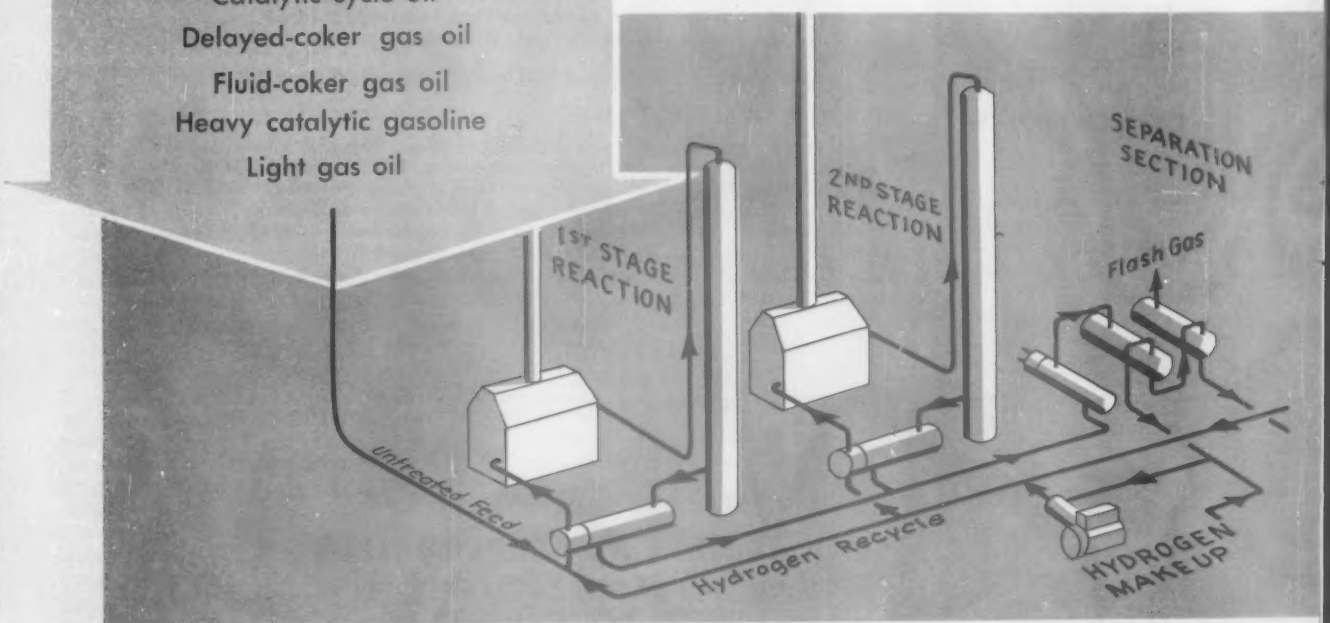
High quality. Light gasoline produced by Unicracking many stocks can be blended directly to premium. C_7-400° F. naphtha from all stocks so far studied has a high cycle and isoparaffin content, making it a superior reforming stock. In some cases this fraction can be blended into the regular gasoline pool. Premium jet fuels can be produced without further treatment directly from paraffinic or moderately aromatic stocks.

Economy. Greater over-all conversion efficiency can be realized by processing lighter gas-oils in a Unicracker and heavier stocks in the catalytic cracker. The process shows an attractive payout because of its reasonable capital and operating costs and because of the excellent yields.

Nearly complete desulfurization, denitrogenation, and olefin saturation are obtained. And the yields show a high ratio of isoparaffins to normal paraffins. Production of dry gas and coke is negligible.

Typical Feed Stocks

Catalytic cycle oil
Delayed-coker gas oil
Fluid-coker gas oil
Heavy catalytic gasoline
Light gas oil



Fuel-oil production is cut by two mechanisms: conversion of excess cutter stock or heating oil to gasoline and cracking to high conversion levels. The higher yield of gasoline and premium midbarrel at the expense of fuel oil permits reduction of refinery crude rate.

Heart of the Unicracking process is a dual-function catalyst which possesses a balance between hydrogenation and cracking activities. It can be regenerated repeatedly, and it shows a high tolerance toward sulfur and nitrogen compounds.

Process Flow

In this fixed-bed process, untreated feed is introduced into the first-stage reaction system where 30 to 50% of feed is converted to gasoline. Unconverted oil is fed to the second stage and is recycled to meet fresh-feed conversion requirements. In this stage conversion to gasoline is 50 to 70% per pass. Two-stage cracking maximizes liquid yields and onstream periods between regenerations.

Reactor effluents from both stages are brought together and, after appropriate cooling and liquid-gas separation, the liquid enters a common fractionator. Production of a diesel stock as shown on the flow diagram is optional.

Depending on the feed stock and process objective, reactor temperatures range from 600° to 800° F. and pressures vary from 500 to 2,000 psig. Optimum feed boiling range is usually about 400°-600° F.

Yield-Quality Data

Catalytic cycle oil. Feed and product data are given in Table 1 for Unicracking a West Texas fluid catalytic cycle oil. C_4-400° F.-e.p. gasoline was produced at over 120% conversion efficiency (defined as the volume of gasoline produced per barrel of feed converted). Dry-gas production is low and consists principally of propane.

Octane of the C_7-400° F. gasoline increases as the aromatic content of the feed increases, and octane ratings of unreformed stock as high as 97 F-1 + 3 ml. TEL have been obtained from more highly aromatic oils. This gasoline reforms to 102-104 octane at moderate severity and high yield.

Delayed-coker gas oil. Data are given in Table 1. In going from 75 to 100% conversion, the C_5+ gasoline volume increases from 78.8 to 102.2 vol. % of feed, while the diesel stock is decreasing from about 25% to zero. C_4+ efficiency is nearly constant over this range.

C_7-185° F.-e.p. gasoline from this gas oil was reformed to 101.8 F-1 + 3 ml. TEL at a C_5+ yield of 83.5 vol. %. Because of its lower cyclic content, it reformed to a slightly lower yield than the catalytic cycle oil.

Fluid coker gas oil. A highly olefinic (24 vol. %) high-sulfur (2.46 wt. %) 600° F.-e.p. fluid-coker gas oil showed a yield advantage of about 2 vol. % of feed, higher gasoline octane, and higher hydrogen consumption, when compared to the delayed-coker gas oil. Other results were similar.

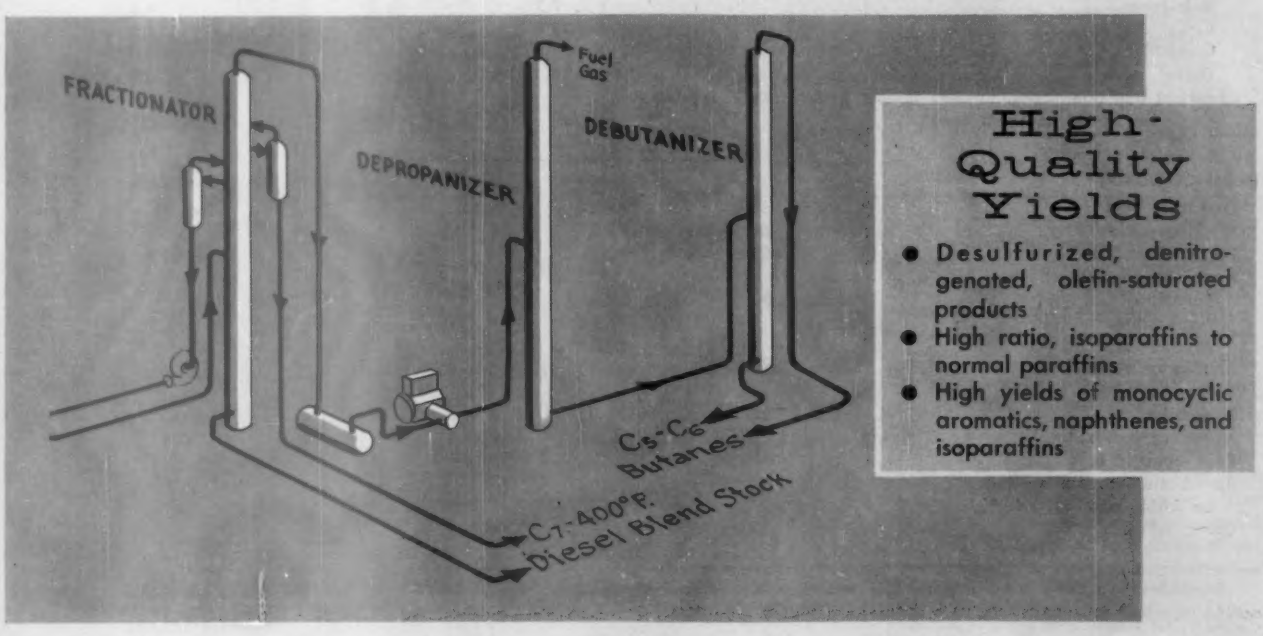
Heavy catalytic gasoline. On a once-through bench-scale operation heavy catalytic naphtha was upgraded from regular to premium-grade blending stock.

Feed-stock inspections: 33.2° API gravity; D 86 boiling range, 358°-467° F.; F-1 clean octane, 86; and F-1 + 3 ml. TEL, 92.6. There was 0.505 wt. % sulfur present and 0.110 wt. % nitrogen.

After Unicracking, the C_7-335° F. naphtha had a 44.8° API gravity and an 86.2 F-1 clean octane. Hydrocarbon analysis showed 8 vol. % n-paraffins, 16% isoparaffins, 37% naphthenes, and 39% aromatics.

This stock after reforming showed a 90.0 vol. % yield of C_5+ naphtha, based on reformer feed. F-1 clear octane improved from 86.2 to 101.7 and F-1 + 3 ml. TEL improved from 93.8 to 104.1.

Economics. The economics obviously depend on the objectives, existing refinery situation, product price,



High-Quality Yields

- Desulfurized, denitrogenated, olefin-saturated products
- High ratio, isoparaffins to normal paraffins
- High yields of monocyclic aromatics, naphthenes, and isoparaffins

and method of integration with existing facilities.

However, in one estimate prepared for Union, direct operating costs range from 23.9 cents per barrel for a 15,000-bbl. per day plant operating at 70% conversion to 32.4 cents per barrel for a 5,000-bbl.-per-day plant operating at 90% conversion. Capital investment of a boundary-limits unit, including first catalyst charge, ranges from $3,800,000 for the 5,000-bbl. unit to $7,200,000 for the 15,000-bbl. unit. Catalyst replacement cost is conservatively estimated at 5 to 6 cents per barrel.

There are several economic advantages to installing a Unicracker over another cat cracker. Among them:

1. Unicracker produces a higher gasoline yield and no fuel oil.

2. Quality of the gasoline pool is higher, with lower sulfur and nitrogen content, lower olefin content, lower sensitivity, and higher volatility.

3. From 10 to 50% high-quality diesel may be produced from low-octane stocks by simply lowering the conversion.

4. Existing cat cracker efficiency is improved by cracking only the heavy oils instead of the full-range gas oils.

Where does it fit? Cracking refractory, hydrogen-poor middle distillates is the application of most interest to refiners. In this application a typical refinery could have alkylation, or catalytic polymerization, or both. And it could have coking or visbreaking of vacuum bottoms, or both.

Refractory stocks from the catalytic cracker, coker, and thermal cracking units, boiling from 400°-600° F., are fed to the Unicracker. A portion of these stocks also supplies the heating-oil demand. Virgin gas oil, heavy coker, and heavy visbreaker gas oils are fed to the cat cracker. Light-oil thermal cracking is eliminated. Light olefins from the cat cracker are alkylated, with isobutane from the Unicracker maintaining butane balance.

Other applications of interest:

1. Feed is about 40% high-sulfur, low-gravity crude, and the remainder is low-sulfur crude. Unicracking the light coker, cat cracker, and high-sulfur, high nitrogen virgin gas oils gives a good payout.

2. Excess reformer hydrogen is used to Unicrack light catalytic cycle oil currently being thermally cracked. Payout on a 4,000-bbl. per day unit is excellent and fuel-oil production is reduced appreciably.

TABLE 1—FEED AND PRODUCT INSPECTIONS FROM TYPICAL CHARGE STOCKS (PILOT PLANT DATA)

FEED STOCK	West Texas catalytic cycle oil	California delayed coker gas oil		
Gravity, °API	25.9	29.7		
Distillation range, D 158, ° F.	446-577	390-600		
Sulfur, wt. %	1.17	1.75		
Nitrogen, p.p.m. total	70.0	1,340		
YIELDS				
Conversion, fresh feed to				
400° F. e.p. gasoline, vol. %	90	75	85	100
Total dry gas, s.c.f./bbl. F.F.	77	57	65	82
Liquid product, vol. % F.F.				
n-Butane	5.2	3.2	3.9	5.4
Isobutane	7.7	6.2	7.6	9.4
C_5-C_6	23.0	17.4	21.1	26.0
C_7-400° F.	71.7	61.4	67.7	76.2
Diesel stock	10.7	24.9	14.0	0.0
Chemical hydrogen consumption, s.c.f. per barrel of fresh feed*	2,240	1,390	1,510	1,730

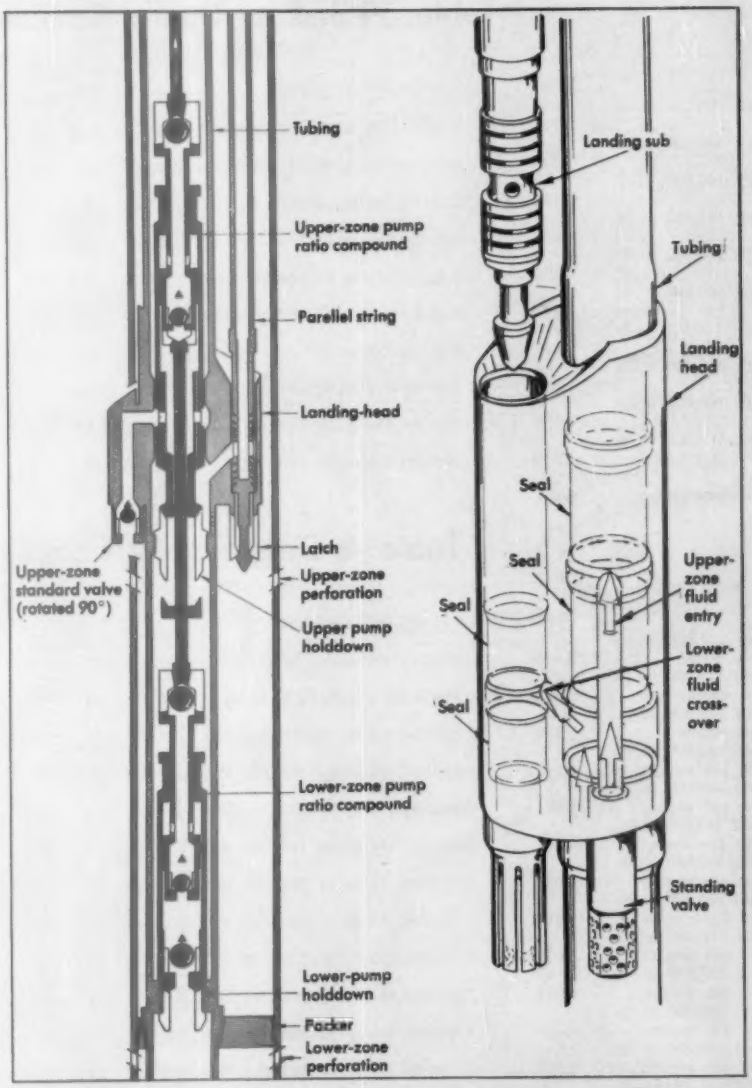
PRODUCT QUALITY	C_5-C_6	C_7-400° F.	Diesel	C_5-C_6	C_7-400° F.
Gravity, °API	82.0	43.7	40.6	82.5	48.4
F-1 clear octane	86.5	75.0	.....	85.2	63.3
F-1 + 3 ml. TEL	†98.5	90.0	.....	98.3	82.1
Hydrocarbon analysis, vol. %					
Paraffins	80	25	.....	73	31
Naphthenes	17	47	.....	24	54
Aromatics	3	28	.....	3	15
Distillation range, ° F.	95-168	224-400	556-630	96-177	225-400
Cetane number	.....	.....	72	.....	.....
Sulfur, p.p.m.	25	21	4	5	1
Nitrogen, p.p.m. total	.....	0.2	1.1	.....	0.4
Pour point, ° F.	.....	.....	40	.....	.....
Ramsbottom carbon residue on 10% bottoms, wt. %	.....	.....	0.29	.....	.....
Color, ASTM D 1500	.....	.....	3.0	.....	.....

*Includes hydrogen used in chemical reactions and excludes solubility losses. †This C_5-C_6 fraction has a blending octane number of 99.5 F-1 + 3 ml. TEL in a typical premium.

How to use tandem rod pumps in dual completions

High costs make dual completions necessary. This presents no unusual problems except when both zones require artificial lift. Cities Service installed its first tandem-pump arrangement in 1956, and it is still in operation. Here is the story of this experience, offered to oil producers as one method of efficient and economical dual artificial lift.

BY M. C. BOYD
Cities Service Oil Co., Odessa, Tex.



HERE IS THE DOWNHOLE EQUIPMENT Cities Service uses in its dual-zone tandem-pump arrangements. A single packer is used and the second tubing string is landed separately. Fig. 1.

THE FIRST tandem pump installation (1956) in the Odessa area by Cities Service Oil Co. was producing from zones at a depth of approximately 8,100 ft. The equipment consisted of a 4½-in.-diameter integral-joint jacket, two crossover tools, a permanent production packer, and a retrievable crossover packer. The upper pump lifts fluid from the lower zone up the 2½-in. tubing. The lower pump lifts fluid from the upper zone through the casing annulus. This method of pumping deep duals is economical, but is not as satisfactory as was expected. However, the well is presently pumping with the same equipment.

In 1957, several shallow dually completed wells were equipped with parallel tubing strings and tandem pumps on a single rod string. All wells were completed with 5½-in. casing. This method of artificially lifting dual zones proved to be both economical and efficient.

How to Do It

A production packer is set near the top of the lower-zone perforations. On the bottom of the main tubing string is a perforated tube, two or three joints of 2-in. regular 10 round-thread tubing with collars turned to 2⅜-in. o.d. and a tubing anchor and seal assembly. In the shallow installations, when the main tubing string is landed, the anchor or locator sub is set on top of the production packer with about 8,000 lb. of weight. A latch-type anchor or locator sub is used in the deep installations and the main tubing string is landed in the production packer with about 10,000 lb. of tension. This acts as a tubing anchor and prevents tubing movement during pumping operations.

The tubing crossover assembly with integral landing head, Fig. 1, is spaced near the bottom of the upper-zone perforations. The lower pump seating shoe is installed a sufficient distance below the crossover assembly to permit operation of the lower pump. This space is governed by the expected pumping-fluid levels, but should be kept at a minimum to prevent rod buckling between the pumps. The maximum distance between pumps of any of the Cities Service installations

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is 1,863 ft. It is important that an accurate measurement of the distance between the lower pump seating shoe and the upper pump bottom lock be obtained after the equipment is made up in the string. This measurement will govern the amount of spacer rods needed between the pumps. Recorded distances between pump seats were questionable in only 2 of 39 installations.

An oversize seating nipple (1.75 + 0.080) is run above the crossover assembly. The nipple is oversized to permit the passage of choke equipment, but will seat a pump in case only one zone requires pumping.

The main tubing string is landed with a dual-string bonnet flanged to the casing housing spool. The 1-in. tubing with a landing spear is run through the remaining opening in the dual bonnet. A rod stripper is used to provide well control while running the tubing. The 1-in. tubing is landed with the landing spear latched into the integral landing head with 3,000 lb. of weight set on the landing head. To unlatch the spear from the landing head requires 2,000-lb. pull above the weight of the tubing. Before the tubing is landed and nippled up, a

TABLE 1

Dual tubing strings:	Coupling (o.d.)
2⅜-in. o.d. EUE API	3.063
1.315-in. o.d. regular	1.660
Collars pass	4.723

Casing, o.d.:	Weight (lb./ft.)	Drift (i.d.)	Clearance (in.)
5½-in.	14	4.887	0.164
5½-in.	15.5	4.825	0.102
5½-in.	17	4.767	0.044
5½-in. extreme line	17	4.653	*0.083

*Clearance obtained by turning down couplings on 2⅜-in. o.d. tubing string to 2.910 in. o.d. Turned down couplings, although practical for certain applications, should be used with caution and handled with reasonable care at all times.

Table 3—Shallow Dually Completed

Well No.	Unit prime mover	Lower pump: Depth	Lower pump: Size and type pump	Current prod.: Oil	Current prod.: Water
1	74-in. stroke, conventional beam unit with 160,000 in.-lb. gear box, 15-hp. electric motor	5,773	2-in. by 1¼-in. by 12-ft. by 16-ft. p.d.	30.6	56.7
2	74-in. stroke, conventional beam unit with 160,000 in.-lb. gear box, 15-hp. electric motor	5,770	2-in. by 1¼-in. by 12-ft. by 16-ft. p.d.	69.3	12.2
3	74-in. stroke, conventional beam unit with 160,000 in.-lb. gear box, 15-hp. electric motor	5,785	2-in. by 1¼-in. by 12-ft. by 16-ft. p.d.	16.1	1.0
4	54-in. stroke, conventional beam unit with 114,000 in.-lb. gear box, 15-hp. electric motor	4,478	2-in. by 1¼-in. by 12-ft. by 16-ft. p.d.	4.6	4.1
5	54-in. stroke, conventional beam unit with 114,000 in.-lb. gear box, 15-hp. electric motor	4,437	2-in. by 1¼-in. by 12-ft. by 16-ft. p.d.	16.8	11.2
6	74-in. stroke, conventional beam unit with 160,000 in.-lb. gear box, 15-hp. electric motor	4,377	2-in. by 1¼-in. by 12-ft. by 16-ft. p.d.	20.3	13.5
7	74-in. stroke, conventional beam unit with 160.000 in-lb. gear box, 15-hp. electric motor	5,647	2-in. by 1¼-in. by 12-ft. by 16-ft. c.	6.0	9.0
8	74-in. stroke, conventional beam unit with 160,000 in.-lb. gear box, 15-hp. electric motor	5,808	2-in. by 1½-in. by 16-ft. c.	102.0	40.0
9	74-in. stroke, conventional beam unit with 160,000 in.-lb. gear box, 15-hp. electric motor	6,159	2-in. by 1¼-in. by 12-ft. by 16-ft. p.d.	11.7	3.4
10	74-in. stroke, conventional beam unit with 160,000 in.-lb. gear box, 15-hp. electric motor	5,839	2-in. by 1½-in. by 16-ft. c.	19.3	19.3

c.—conventional type pump. p.d.—positive displacement type pump.

Table 4—Deep Dually Completed

Well No.	Unit prime mover	Lower pump: Depth	Lower pump: Size and type pump	Current prod.: Oil	Current prod.: Water
1	64-in. stroke conventional beam unit with 228,000 in.-lb. gear box, 40-b.hp., 6-cylinder, 4-cycle gas engine	8,575	2-in. by 1¼-in. by 12-ft. by 16-ft. p.d.	27	9
2	108-in. stroke conventional beam unit with 579,000 in.-lb. gear box, 40-b.hp., 6-cylinder, 4-cycle gas engine	9,342	2½-in. by 1½-in. by 15-ft. by 19-ft. p.d.	64	1
3	108-in. stroke conventional beam unit with 579,000 in.-lb. gear box, 40-b.hp., 6-cylinder, 4-cycle gas engine	8,589	2-in. by 1¼-in. by 15-ft. by 20-ft. p.d.	22	15
4	192-in. stroke air counterbalanced unit with 640,000 in.-lb. gear box, 70-b.hp., single-cylinder, 2-cycle gas engine	8,595	2-in. by 1¼-in. by 26-ft. by 30-ft. c.	36	0
5	192-in. stroke air counterbalanced unit with 640,000 in.-lb. gear box, 70-b.hp., single-cylinder, 2-cycle gas engine	8,697	2-in. by 1¼-in. by 26-ft. by 30-ft. p.d.	26	0
6	192-in. stroke air counterbalanced unit with 640,000 in.-lb. gear box, 70-b.hp., single-cylinder, 2-cycle gas engine	10,067	2-in. by 1¼-in. by 26-ft. by 30-ft. p.d.	117	7
7	192-in. stroke air counterbalanced unit with 640,000 in.-lb. gear box, 70-b.hp., single-cylinder, 2-cycle gas engine	10,088	2-in. by 1¼-in. by 26-ft. by 30-ft. p.d.	22	124
8	192-in. stroke air counterbalanced unit with 640,000 in.-lb. gear box, 70-b.hp., single-cylinder, 2-cycle gas engine	10,591	2-in. by 1¼-in. by 26-ft. by 30-ft. p.d.	122	31
9	74-in. stroke conventional beam unit with 228,000 in.-lb. gear box, 37-b.hp., single-cylinder, 2-cycle gas engine	8,073	2-in. by 1¼-in. by 25-ft. by 29-ft. c.	12	100
10	120-in. stroke conventional beam unit with 320,000 in.-lb. gear box, 37-b.hp., single-cylinder, 2-cycle gas engine	8,093	2-in. by 1¼-in. by 20-ft. by 24-ft. p.d.	149	4
11	192-in. stroke air counterbalanced unit with 640,000 in.-lb. gear box, 70-b.hp., single-cylinder, 2-cycle gas engine	8,044	2-in. by 1¼-in. by 26-ft. by 30-ft. p.d.	62	0
12	192-in. stroke air counterbalanced unit with 640,000 in.-lb. gear box, 70-b.hp., single-cylinder, 2-cycle gas engine	8,529	2-in. by 1¼-in. by 26-ft. by 30-ft. p.d.	58	39
13	192-in. stroke air counterbalanced unit with 640,000 in.-lb. gear box, 70-b.hp., single-cylinder, 2-cycle gas engine	8,581	2-in. by 1¼-in. by 26-ft. by 30-ft. p.d.	137	34

c.—conventional type pump. p.d.—positive displacement type pump.

trial unlatching should be performed to make certain that the spear is latched into the head. The top sub on the 1-in. tubing string is a changeover sub from 10 round-thread regular to 8 round-thread EUE. After the 1-in. tubing is landed, the slips are set and the packing installed in the tubing bonnet.

The pump depth and fluid-withdrawal rate determine the rod-string design which, in turn, determines the side of the main tubing string.

Shallow wells with pumping depths of less than 6,000 ft. do not present any problem. Two-inch tubing is large enough for a string of ¾-in. and ⅞-in. rods. The shallow wells were

TABLE 2

Dual tubing strings:	Joint o.d. (in.)
2⅜-in. o.d. API EUE integral joint	3.094
1.315-in. o.d. integral joint	1.552
Collars pass	4.646

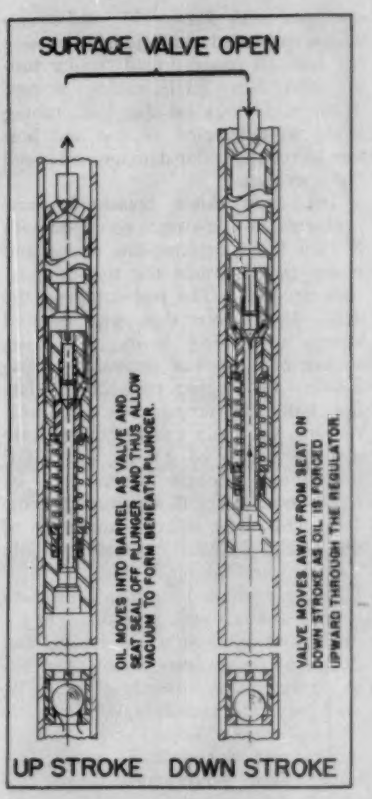
Casing, o.d.:	Weight (lb./ft.)	Drift (i.d.)	Clearance (in.)
5½-in.	14	4.887	0.241
5½-in.	15.5	4.825	0.179
5½-in.	17	4.767	0.121
5½-in. extreme line	17	4.653	0.007

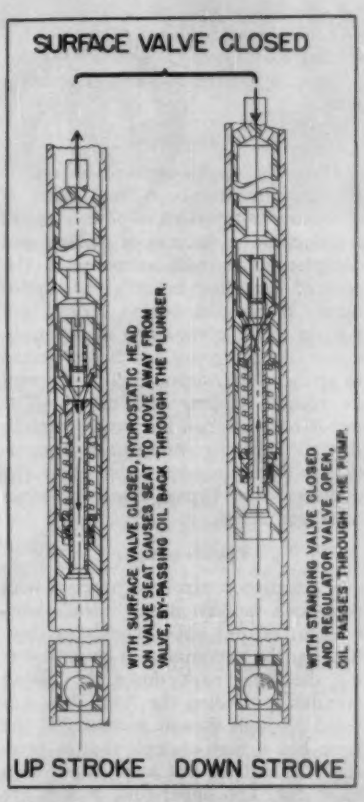
Wells with Tandem Rod Pumps

Distance between pump seats	Upper pump: Depth	Upper pump: Size and type pump	Current prod.: Oil	Current prod.: Water
68	5,705	2-in. by 1½-in. by 16-ft. p.d.	66.5	22.1
86	5,684	2-in. by 1½-in. by 16-ft. p.d.	70.1	2.9
68	5,717	2-in. by 1½-in. by 16-ft. p.d.	56.0	2.4
69	4,409	2-in. by 1½-in. by 16-ft. p.d.	51.2	17.1
98	4,339	2-in. by 1½-in. by 16-ft. p.d.	73.2	12.9
68	4,309	2-in. by 1½-in. by 16-ft. p.d.	65.8	19.7
69	5,578	2-in. by 1½-in. by 16-ft. p.d.	72.4	217.2
68	5,740	2-in. by 1¼-in. by 12-ft. by 16-ft. c.	92.7	11.1
1,863	4,296	2-in. by 1½-in. by 12-ft. by 16-ft. p.d.	84.7	16.2
68	5,771	2-in. by 1¼-in. by 12-ft. by 16-ft. c.	20.0	8.6

Wells with Tandem Rod Pumps

Distance between pump seats	Upper pump: Depth	Upper pump: Size and type pump	Current prod.: Oil	Current prod.: Water
100	8,475	2-in. by 1½-in. by 16-ft. p.d.	23	8
803	8,539	2½-in. by 1½-in. by 16-ft. p.d.	74	3
98	8,491	2-in. by 1½-in. by 20-ft. p.d.	...	...
97	8,498	2-in. by 1½-in. by 28-ft. p.d.	21	1
96	8,601	2-in. by 1½-in. by 28-ft. p.d.	63	13
100	9,967	2-in. by 1½-in. by 28-ft. p.d.	26	2
98	9,990	2-in. by 1½-in. by 28-ft. p.d.	19	130
98	10,493	2-in. by 1½-in. by 28-ft. p.d.	15	3.5
87	7,986	2½-in. by 1¾-in. by 25-ft. by 30-ft. c.	12	3
100	7,993	2-in. by 1½-in. by 28-ft. p.d.	51	0
97	7,947	2-in. by 1½-in. by 28-ft. p.d.	47	5
99	8,430	2-in. by 1½-in. by 28-ft. p.d.	23	85
97	8,484	2-in. by 1½-in. by 28-ft. p.d.	53	160


SURFACE VALVE OPEN
OIL MOVES INTO BARREL AS VALVE AND SEAT SEAL OFF PLUNGER AND THUS ALLOW VACUUM TO FORM BENEATH PLUNGER.
VALVE MOVES AWAY FROM SEAT ON DOWN STROKE AS OIL IS FORCED UPWARD THROUGH THE REGULATOR.
UP STROKE
DOWN STROKE


SURFACE VALVE CLOSED
WITH SURFACE VALVE CLOSED, HYDROSTATIC HEAD ON VALVE SEAT CAUSES SEAT TO MOVE AWAY FROM VALVE, BY-PASSING OIL BACK THROUGH THE PLUNGER.
WITH STANDING VALVE CLOSED AND REGULATOR VALVE OPEN, OIL PASSES THROUGH THE PUMP.
UP STROKE
DOWN STROKE

USE of Type D Otis regulated cage assembly as an overload valve in two-zone pumps. Fig. 2.

equipped with 5½-in. 15.5-lb. casing which provided sufficient clearance for 1-in. 10 round-thread regular tubing and 2-in. EUE tubing strings, Table 1. Collars on the 1-in. tubing string were beveled on top and bottom to reduce collar damage and speed the operation.

The deep duals presented some problems, as a few were equipped with 5½-in. 17-lb. extreme-line casing and pump depths made the use of 1-in. rods necessary. The rod strings in the deep duals were three-way tapered strings of ¾-in., ⅞-in., and 1-in. sucker rods. It was necessary to use 2⅞-in. o.d. tubing to accommodate the 1-in. rod string. For economic reasons, the main tubing strings were tapered strings of 2⅜-in. o.d. EUE tubing and enough 2⅞-in. o.d. integral-joint tubing to accommodate the 1-in. rods. The internal diameter of the casing required the use of 1-in. integral-joint tubing, Table 2.

The pumps and surface equipment were also sized with consideration for depth and fluid-withdrawal rate. Size of the pumping units varied from 54-in. stroke units with 114,000 in.-lb. gear box and conventional beam, to 192-in. stroke units with 640,000 in.-lb. gear box and air counterbalance. Prime movers varied from 15-hp. electric motors to 70-hp. single-cylinder, two-cycle gas engines.

Tables 3 and 4 show some of the surface installations, size and types of pumps, setting depths, and production tests.

Advantages

Probably the greatest advantage of the tandem-rod pump installation is economy. Using tandem pumps allows a reduction in the cost of drilling and completing, as well as reducing the cost of installing artificial-lift equipment. If parallel tubing strings are run on initial completion of the well, either or both zones can be converted to artificial lift without killing the well or round-tripping the tubing. The upper-zone gas can be vented through the casing-tubing annulus and a variation in the equipment will allow the addition of a bypass line for lower-zone gas relief.

Disadvantages

Production control is a problem with dual-zone tandem pump installations. Control of the upper zone's production can be accomplished by circulating the fluid back down the casing annulus, providing the zone does not build up high shut-in pressure. If the zone has a high-enough shut-in pressure, the stuffing box may leak or even blow out. The upper-zone pumps are either 1½-in. or 1¼-in. bore which have an effective bore of 1¼-in. or 1-in., respectively, due to the pump polished-rod extending throughout the pump. Application of the different-sized pumps will help control the upper-zone production.

For control of production from the lower zone, a back-pressure valve, which replaces the upper ball and seat, can be installed in the lower pump. For operation of this valve, the pump necessarily has to be a conventional-type pump. By shutting in the lower-zone production, pressure is built up in the tubing, causing the spring-loaded valve to function, Fig. 2. This valve is relatively new and has experienced operational difficulties due to the ports being plugged with paraffin, gyp, sand, or other material. It is likely that a satisfactory model of this valve or similar equipment will be developed to positively control overproduction from the lower zone.

Paraffin buildup in the 1-in. tubing string can be controlled by circulating hot oil down the casing annulus, cutting paraffin; or a portion of the 1-in. tubing string may be plastic-coated. Paraffin knives are available for the small tubing. Plastic-coated strings have eliminated paraffin buildup in some paraffin-problem wells.

Cost Comparison

A comparison of monthly direct equipment expense, including all repairs, pulling costs, and paraffin cutting, was made between deep pumping duals and deep pumping singles. The average monthly equipment expense of the deep duals was $66.68 as compared to $20.25 for the singles. This amounts to 0.04051 cent per barrel of oil (dual) as compared to 0.02969 cent per barrel of oil (single) and 0.01736 cent per barrel of fluid (dual) as compared to 0.009427 cent per barrel of fluid (single).

Esso program boosts oil heating

THE ESSO STANDARD Division of Humble Oil & Refining Co. hopes to sell more by selling less. Beginning May 1 it will offer its heating-efficiency program to interested heating-oil marketers in its territory.

The heating-efficiency program—HEP for short—improves the efficiency of a homeowner's oil-heating plant. In a test involving 130 homes in Pelham, N. Y., an average annual saving of 390 gal., or 20.1%, was effected.

By improving the efficiency of oil heating, Esso expects to be better able to counter the inroads of natural gas. It feels that, in the long run, by selling less oil to more customers through better efficiency it will sell more oil.

The new program was developed after research showed that by reducing the firing rate, it is possible to cut stack temperatures and down-time stack losses. It was also found that by increasing turbulence, it is possible to improve combustion, reduce smoke, and produce a hotter fire.

Esso developed a spray pattern device which makes it possible to match the nozzle spray to the air pattern developed by each burner.

Cost of the modification to the home owners who bought the service averaged $68 and predicted annual savings is $65. Esso lost no money on the operation. It found it could sell the job at a price that included a 30% gross profit.

Checking back on the first customers Esso found: 41% felt there were some savings; 55% said their investment was worth while; 82% said their homes were more comfortable; and 72% said the morning pickup was as quick or quicker. The last was considered especially important because of the reduced firing rate.

C. F. Blood, assistant manager, fuel-oil sales division, told a National Fueloil Council promotional meeting, the best news: "Of paramount interest was the fact that one quarter had considered converting to gas and that half of these were now fully content with oil."

Ruling due in California gas-line squabble

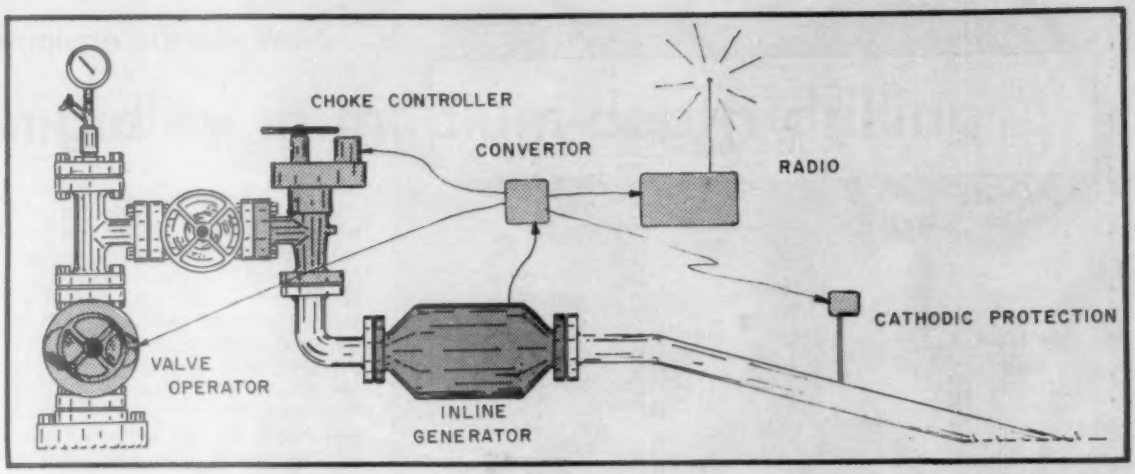
A DECISION is expected within 90 days on Richfield Oil Corp.'s contention that the California Public Utility Commission should not regulate operations of a company natural-gas line.

The state supreme court is now considering the case.

The line in question runs 58 miles from the San Joaquin Valley to a Southern California Edison Co. steam electric-generating plant near Ventura. In a straight company-to-company deal, Richfield agreed to supply the plant's needs.

While the line was being built last year, Southern Counties Gas Co., a gas-distributing utility, contended before the PUC that the deal made Richfield a utility and it should be subject to commission control.

The PUC agreed with the distributing company and issued an order to shut down the line pending rate hearings. However, a stay of the shutdown order was granted Richfield by the state high court and is still in effect (OGJ, Aug. 17, p. 112 and Aug. 31, p. 32).



ENOUGH ELECTRICITY is generated by this small in-line unit to do several jobs around the wellhead.

Gas-well stream drives small generator

Lack of electricity has been a major stumbling block in the automation of some gas fields. Now the wells themselves can generate the power needed for their control.

PUSH-BUTTON CONTROL of gas wells in remote, hard-to-reach locations is now possible with a new, small, gas-stream-driven electric generator.

Until now the big holdup in automation has been the lack of electric power necessary for telemetering and control equipment. Gas wells are usually widespread and are seldom within economic range of rural power lines.

Solution obvious. The method of licking this problem has been obvious as long as there have been gas wells, but it took a young Houston electronics company to discover the secret of cheap available power.

Magnetic Industries, Inc., working with Well Electronic Supply Co., has come up with a compact generating unit that bolts right in the flow line from a gas well. By using a slight amount of pressure—about 20 psi.—the generator produces 1,000 watts at 110 volts a.c.

None of the gas is wasted or burned, and this amount of power is more than ample for controls, instruments and radio. In fact, there's enough left over to provide cathodic protection for the well and a portion of the connecting pipeline.

How it works. The generator has been under test for approximately 1 year. It has only two moving parts. A 6-in.-diameter turbine wheel designed for high-volume, low-velocity gas flow is direct-coupled to a permanent-magnet generator. These two elements are enclosed in a compact high-pressure case flanged to bolt into a gas line.

Separating the turbine wheel and generator are mechanical seals with weep holes to eliminate pressure differentials that might cause difficulties. The only purpose of this seal is to keep the direct gas stream off the generator.

The unit will operate on a wide range of pressures and flows. In fact, almost any gas well will produce 500 to 1,500 watts without seriously impairing flow. The pressure drop across the turbine will average something like 20 psi.

The turbine wheel and generator rotor are designed to last for 5 years. But normally, the working parts will be replaced every 2 or 3 years to insure 100% deliverability. The change-out will take only 20 minutes or so. It is a simple matter to unbolt the case head, lift out the assembly, and install a new one.

GENERATING UNIT, in box, uses about 20 psi., and can generate about 1,000 watts at 110 volts a.c.

Unit under test. Several companies have tried out the generator. One company kept one on the flowline from a gas well in South Texas for 4 months. The only difficulty experienced in this installation was that the dirty gas caused a certain amount of pitting of the turbine wheel.

Transcontinental Gas Pipe Line Corp. now has one under test in South Louisiana. After 3 months of continuous operation, the output continues to average about 1,000 watts.

Corrosion engineers are looking into the possibilities of protecting lines in remote sections with power from the generators. And offshore operators are the most enthusiastic of all.

New electric equipment puts big-rig

BY ED McGHEE
Drilling Editor

HERE IS a statement you might never have expected to hear from the owner of a two-engine rig: "Our new rig spudded its first hole with only one engine operating; and with only that one engine, we pumped, rotated, and pulled the pipe until we'd made all our surface hole. There was no difficulty at all."

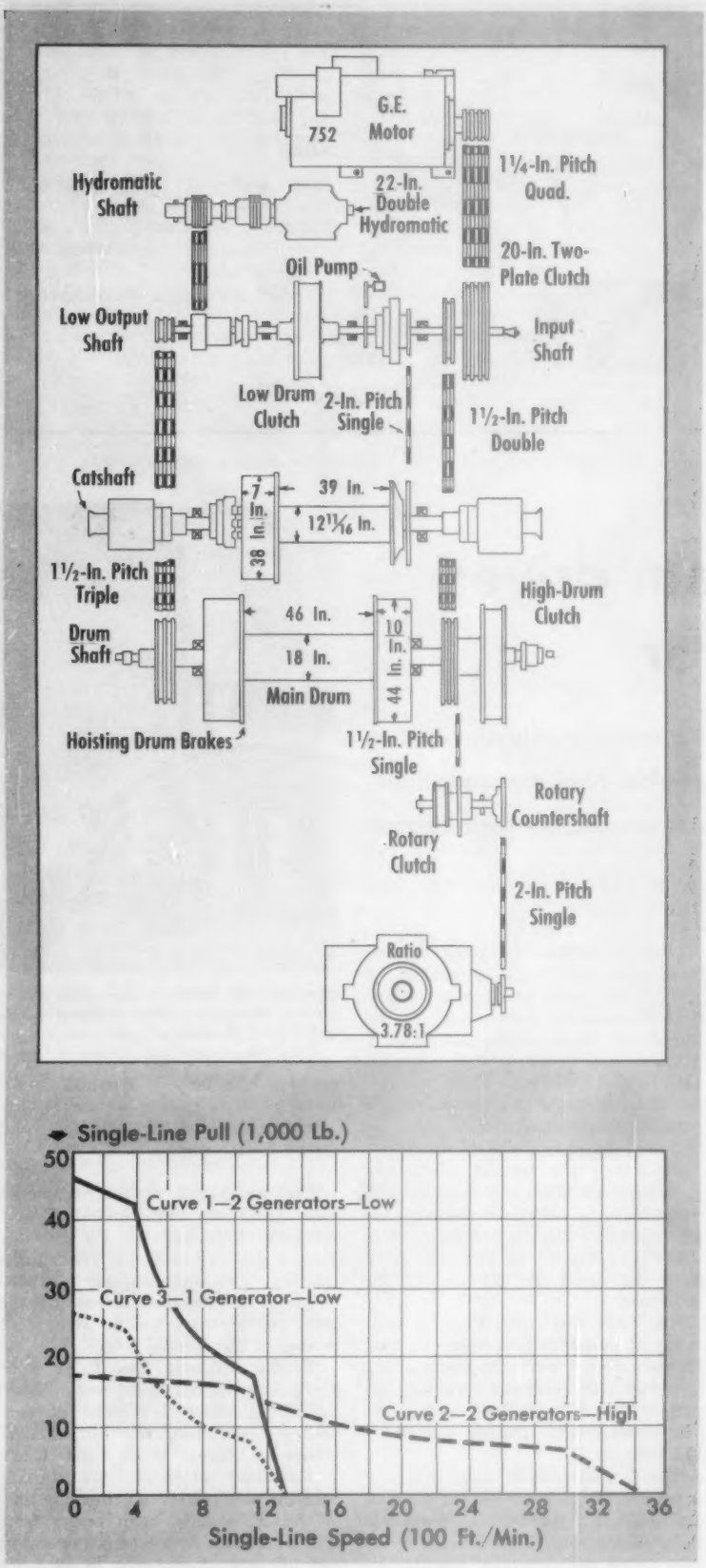
This statement represents the actual experience of Slats Honeymon Drilling Co., Oklahoma City. It is all the more remarkable because the rig is a new d.c. electric model. Until now, electric-rig control systems required a generator for each motor. That is, if only one engine-generator was operating, it could be used on the pump motor alone, or on the draw works alone, but not on both simultaneously.

Controls on Honeymon's rig allow both pump and draw-works motors to be run off a single generator. Moreover, while small, wheel-mounted electric rigs have been built in the past, the Honeymon rig is the first "standard" electric unit in the medium-depth class. All other conventional electric rigs have been for deep drilling.

Like the larger Helmerich & Payne rig described in the January 4, 1960, issue of The Oil and Gas Journal, Honeymon's rig has no shifting transmission. It has only a high-drum and low-drum drive. Thus, there is no transmission maintenance and no time lost in gear shifting.

How to divide output. Splitting current from one d.c. generator into two motors such as the rotary and pump simultaneously is similar to taking steam from a common boiler to two steam engines. To do this it is necessary only to connect both motors in parallel to the generator.

But, since generator output is controlled by the driller's throttle, both motors would run at speeds corresponding to the setting of this throt-



UNLIKE conventional draw works, this one has no shifting transmission. Adjustments in speed and power come from regulation of the d.c. motor and use of either high-drum or low-drum drives. As chart shows, the draw works can put up a single-line pull of 27,000 lb. in low with only one generator operating.

flexibility in medium-depth drilling

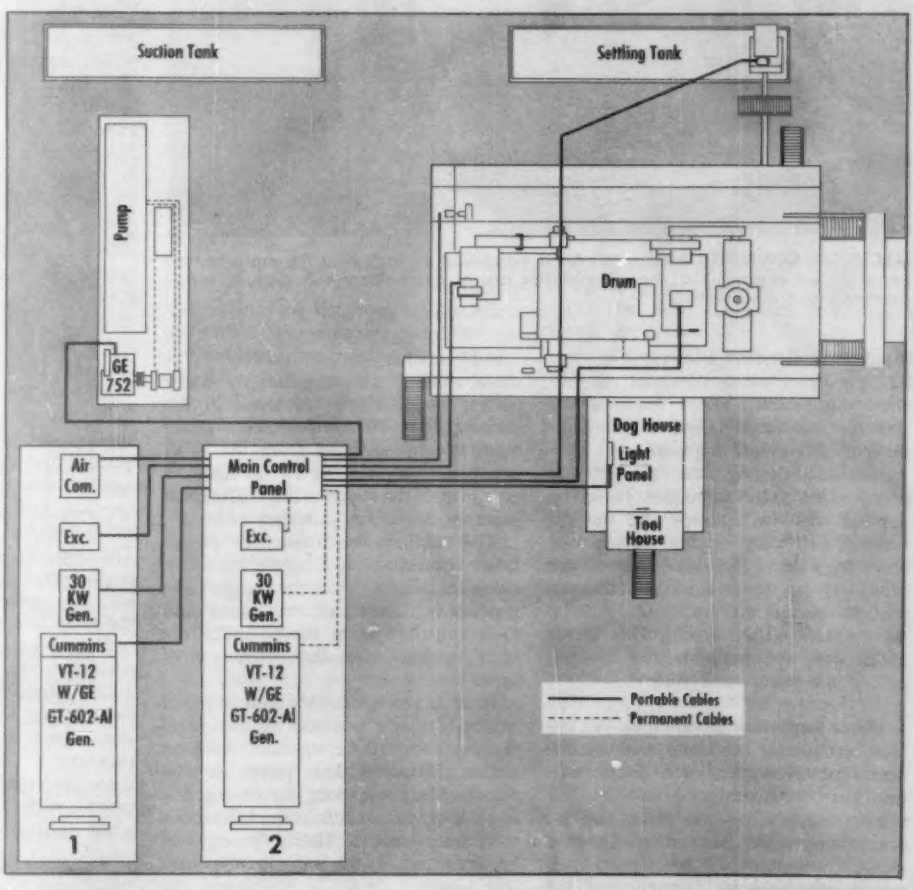
tle unless something further were done to control the motors individually. This something further on the Honeymon rig is provided by additional control switches which adjust the fields of the motors. With these switches, the driller can select motor settings which cause one motor to run faster or slower than the other for a given generator control throttle setting.

The Honeymon rig has six combinations of motor-speed settings, corresponding to six relationships between rotary speed and pump speed when both are driven from the same generator. When total power requirements are within the capability of one engine, this permits the other engine to be shut down to save fuel or serves as a safeguard against the failure of either engine. If the pump requires more power than one engine can deliver, then both generators can be paralleled to supply most of their combined power to the pump, the remainder going to the rotary and auxiliaries.

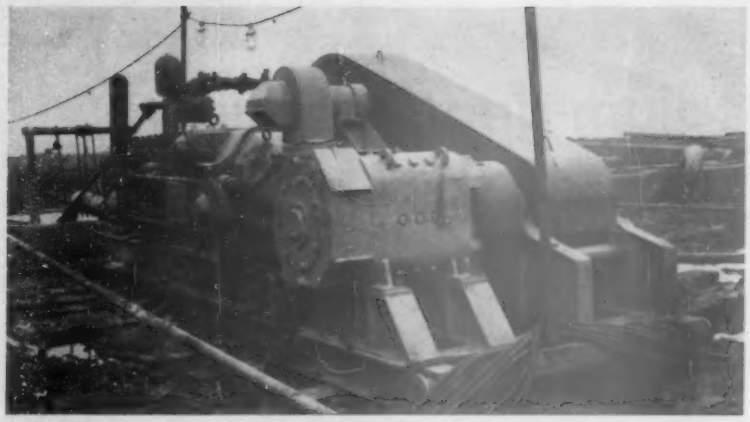
Of course, the generators can be assigned one to the pump and the other to the rotary. In this case speeds are individually adjustable from zero to maximum on either function in infinite steps by the conventional generator control. In addition, the pump-motor speed switch, which has two positions, can be shifted to high to speed up the pump increase volume when pressure is low. Likewise the draw-works motor has three speeds available which can be used for obtaining higher rotary speeds or for hoisting when either or both generators are assigned to this motor.

The new split-generator and motor speed control features are incorpo-

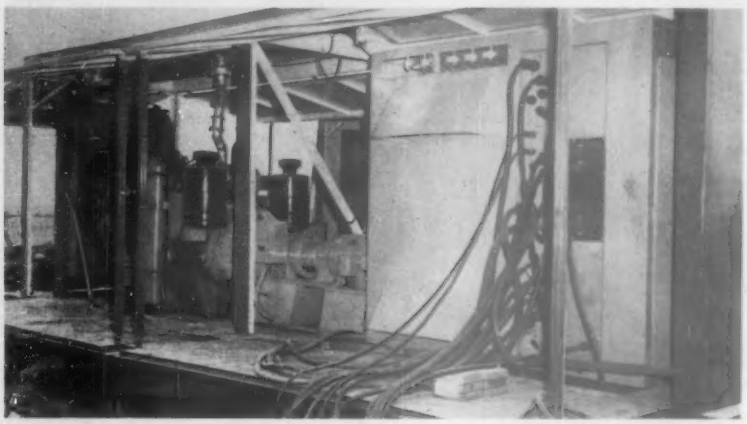
CONTROLS ON RIG are quite simple. Knob switches on control box at right assign rig's two d.c. generators to their loads. Either or both generators may be put on pump motor or on draw-works motor. Rotary can run off same motor as pump.



EACH ENGINE drives a d.c. generator, an exciter, and an a.c. generator. Controls allow rotary and pump to run off a single generator. Or, output of both generators can be put on pump with small amount going to auxiliaries and rotary.



MUD PUMP AND DRIVING MOTOR make compact skid-mounted package. This is the only pump on the rig, but it can be run off same generator as rotary table; rotary has six different speed combinations compared to the pump for any particular generator setting.



ELECTRICAL CONNECTION after moves is simplified by including the main control panel on an engine skid. Portable cables are of quick-disconnect type to speed assembly and disassembly.

rated into General Electric Co.'s V-222 rig drive using standard off-the-shelf equipment. These features are concepts commonly used in many industrial d.c.-motor applications.

Honeymon's rig has only one pump. The same principles could be applied with two pumps and the rotary if sufficient engine horsepower were available. The two engines are rated 430 hp. (continuous); auxiliaries require about 60 hp. and can be driven from either engine. This leaves about 800 hp. available for hoisting or for the pump and rotary.

Other important advantages. All cables on the rig are the quick-disconnect type. However, such disconnecting has been designed out of the system by placing the main control compartment on one of the engine skids. Thus, many of the cables which would otherwise be disconnected for moves are built permanently into the engine skid.

All auxiliary-motor controls (for shale shaker, air compressor, water pump, etc.) are also included in the main control compartment. These controls are operated from the driller's panel so that there's no need to go through the usual widely dispersed junction boxes for auxiliary control.

The auxiliary loads get their power from brushless a.c. generators on common shafts with the larger d.c. generators. These a.c. machines and their control system should make the light system virtually maintenance-free.

Even if the operator's control panel at the driller's position is damaged, the rig can still be operated without undue difficulty. This panel can be disconnected by using an emergency console cutout switch in the main control compartment. Then, the rig can be operated if the air throttles are still intact.

Equipment and men are protected by a grounded power system which has proved quite successful on other rigs. This system is credited with keeping maintenance of electric equipment quite low.

In addition to the above features, the Honeymon rig has other advantages common to electric drive. Rig-up and moving time are a minimum; fewer trucks are necessary to place equipment on the substructure.

Preparation of the well location is simpler. And, the equipment is well dispersed about the location so that there is maximum safety for the men and less possible loss to equipment in case of fire. Diesel-fuel tanks rest on the ground; there's no need for a substructure or other means of elevating them. And, the power plant probably makes better use of the fuel supply.

Investment in spare parts and expendable items is low. Honeymon expects that maintenance cost will be low on the electric equipment, engines, draw works, and other equipment.

Individual pieces. The pictures on these pages were taken on the new rig's first location, British-American's 1 Swanda near Apache, Okla. Draw works is a double-drum drive unit which contains no shifting transmission other than the high-drum and low-drum drives. With the power from only one engine, the draw works can put up a single-line pull of 27,000 lb. in low. With both engines, 47,000 lbs. is available in low.

The draw works contains a speed-increaser chain drive to a 15-in. double hydromatic auxiliary brake. Rotary drive is off the high-drum sprocket. Both draw works skid and pump skid carry a direct-current motor. The motors drive through chains to their respective loads.

Rig power is supplied by two diesel engines, each driving a d.c. generator. Besides the engine-generator set, the number one engine skid has the 30-kw. a.c. generator, an exciter for the d.c. generator, and an air compressor. The No. 2 engine skid carries the engine-generator set plus another 30-kw. a.c. generator, the exciter, and the main control panel.

Either a.c. generator or exciter is adequate; the second units represent 100% standby. The single air-compressor can be run by a small gasoline engine until it builds up enough pressure to start the main engines; then, the compressor is run by an a.c. motor with current from the light-plant generator.

Acknowledgment

The author thanks G. W. Webb, General Electric Co., Dallas, for his assistance in preparation of this article.

In West Texas drilling . . .

Clay-free salt-water muds save rig time and bits

BY B. J. COLLINGS
Area Drilling Foreman, Goldsmith District,

and

R. R. GRIFFIN
Drilling Engineer, Midland District,
Gulf Oil Corp.'s Midland, Tex., Division

FIELD TRIALS of a newly introduced mud are bringing outstanding results in West Texas drilling.

This promising fluid contains extremely few solids—some 2% compared to the 6 to 12% of conventional muds of the same weight. And, through use of guar gum and starch, water loss is held below 10 cc. This "clay-free" fluid has shown these advantages over older muds with higher solids content:

1. It increases penetration rate.
2. It lengthens bit life.
3. It costs less or no more than conventional muds in the viscosity range from 32 to 35 seconds funnel.

In systems with funnel viscosity higher than 40 seconds, cost may be higher compared to low-viscosity fresh-water muds which are unweighted (8.7 to 9.3 lb. per gal.)

Many operators have already adopted the clay-free salt-water mud for drilling shallow wells with the salt section exposed. The fluid is less frequently used in drilling below the intermediate string in deep wells. It would likely be more widely used for this type of drilling if an improved gum were available to yield high viscosity. The more viscous fluid may be necessary in some wells to properly remove cuttings from the hole. However, as geologists become more familiar with conditions in a particular area, they are better able to evaluate formations from smaller-size samples.

Lower and lower solids. Reduction of solids content has been a dominant trend in the drilling fluids used in West Texas. Originally, two conventional types of mud were used exclusively. These were the bentonite-chemically treated fresh-water mud and the salt-water clay-starch mud.

Later, the conventional fresh-water mud (solids content 10 to 15%) was replaced. As a first step, its place was taken by low-solids sodium carboxymethyl cellulose (CMC) type mud, in which high-viscosity CMC was substituted for part or all of the commercial clay used to build viscosity. Solids content of this fluid can be maintained in the range from 6 to 12%.

The low-solids CMC drilling fluids were successful in generally raising penetration rate, prolonging bit life, preventing loss of circulation, and lowering mud costs.

Then efforts began to improve the conventional salt - water clay - starch muds. Improvement was particularly needed in shallower wells which are drilled to total depth with the salt section exposed. There were problems to overcome:

1. Common practice was to use fresh water to drill the salt section. This always resulted in greatly enlarged holes through the salt beds. Hole diameters grew to such size that annular velocity was almost entirely lost. Removing cuttings became quite difficult. Compensating, higher viscosities were used, which in turn increased solids content. A solution to this problem was found in developing economical sources of salt brine. After the saturated brine became cheaper, it was popular for water addition to mud systems.

2. There was difficulty in removing native solids from salt-water fluid when drilling with the salt section and red beds exposed. A partial solution to this problem was found in the use of flocculants in combination with a large settling area or desanders.

3. There was no economical additive which in low concentration would build viscosity in salt water. The development of gum for mud use has helped toward a solution. While this additive raises viscosity and reduces filtrate loss on initial mixing, after a few hours filtrate control was lost. Small additions of starch counteracted this instability.

The next step. With the experience gained from clay-free salt-water drilling fluids on shallow two-casing-string wells, we were ready for the next step toward lower - solids drilling fluids. This step was replacing the fresh-water-mud systems on deep holes with unsaturated or saturated clay - free salt-water muds.

Whereas the low-solids CMC-type muds run about 6-10% solids, the clay-free salt-water drilling fluids have solids content of 2% or less in the 8.4-10-lb. per gal. density range. The advantages of drilling below the intermediate string of casing (which cases off the salt beds) with this type mud are:

1. Faster penetration.
2. Longer bit life.
3. Less pump wear.
4. Better hydraulics.
5. Inhibition of shale hydration.
6. Lower mud cost in 10-lb. per gal. density range.

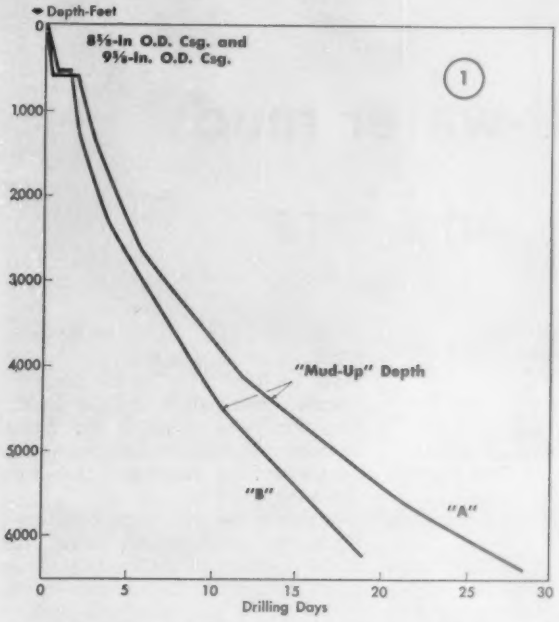
Disadvantages of drilling deep holes with this type of mud are:

1. Conventional electrical logs are of little or no value.
2. The mud had very low thixotropic properties.
3. It probably will not suffice in drilling some of the more troublesome shales.
4. It probably will not be satisfactory for any well in which the hole diameter becomes greatly enlarged.
5. It creates more corrosion problems.
6. The system ferments in some unsaturated salt waters unless preservative is added.

Some of these disadvantages would appear to rule out use of this type of fluid in most deep wells. This is not necessarily true. Generally, it is probable that the low-viscosity (33-40 funnel seconds) clay-free salt-water drilling fluid can be used satisfactorily in areas where wells have been drilled with relatively low-viscosity (40-50 funnel seconds) conventional fresh-water muds. Information compiled from the drilling of thousands of wells in West Texas should determine the feasibility of such mud programs.

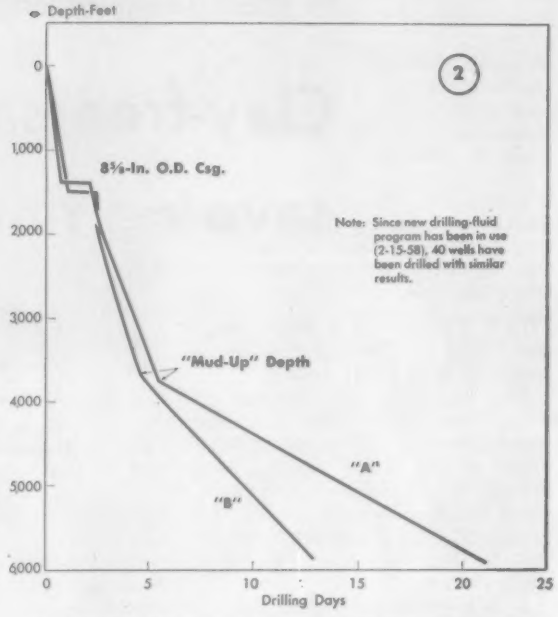
The use of this very low-thixotropic

Amerfield drilling comparison



WELL	"B"	"A"
TYPE MUD	NO CLAY – STARCH – GUM 8 % OIL 2 % SOLIDS	SALT WATER CLAY – STARCH 8 % OIL 10 % SOLIDS
BITS	23 – 8 3/4"	46 – 7 7/8"
DAYS	19	28.5
MUD COST	$ 2599	$ 2470

Goldsmith 5,600-ft. drilling comparison



WELL	"B"	"A"
TYPE MUD	NO CLAY STARCH 20% OIL 2-3% SOLIDS	SALT WATER CLAY STARCH 20% OIL 8-12% SOLIDS
BITS	16	21
DAYS	13	21
MUD COST	$ 1200	$ 2300

Fig. 1. In the Armer field, Crane County, the drilling program consists of setting 8⅝-in. o.d. casing near 600 ft. and drilling with the salt section exposed to total depth of approximately 6,400 ft. Saturated salt water is the drilling fluid to 4,500 ft., after which mud is used to total depth. Well "A" was drilled with an oil-emulsion salt-water clay mud, while Well "B" was drilled with an oil-emulsion clay-free salt-water mud. Results show Well "B" has:

1. A 30% reduction in drilling days.
2. A 50% reduction in bits.
3. Essentially the same mud cost.

In comparison, it must be noted that the drilling contractor used an all-out effort to improve drilling with better hydraulics and more bit weight. However, this contractor attributes a large part of the improvement to the drilling-fluid program.

Fig. 2. In Goldsmith 5,600-ft. field, Ector County, surface casing is set near 1,400 ft. and salt water is used as the drilling fluid to 3,800 ft. Then, mud is used to total depth of 5,900 ft. Well "A" used a conventional oil-emulsion salt-water clay mud, while Well "B" used an oil-emulsion clay-free salt-water mud. Results indicated Well "B" had:

1. A 38% reduction in drilling days.
2. A 24% reduction in bits.
3. A 48% reduction in mud cost.

These two wells were drilled under similar conditions, including same contractor, same bit weight, and r.p.m.

---

drilling fluid would seem to be very hazardous in case the fluid movement in the annulus were interrupted. However, field cases indicate that recovering a fish after twistoff is no more difficult than when drilling with conventional muds. This could possibly be explained by the fact that in this hard-rock, slow-drilling region there are usually not enough cuttings in the annulus when fluid movement ceases to cause sticking of drill pipe.

In salt-water muds, where conventional electrical logs are not satisfactory, other logs not adversely affected by the fluid surrounding the electrodes are used. Such logs are the Laterolog, the Microaterolog, the gamma ray-neutron, and the gamma ray-sonic log.

What is contains. The initial make-up of a clay-free salt-water mud has the following:

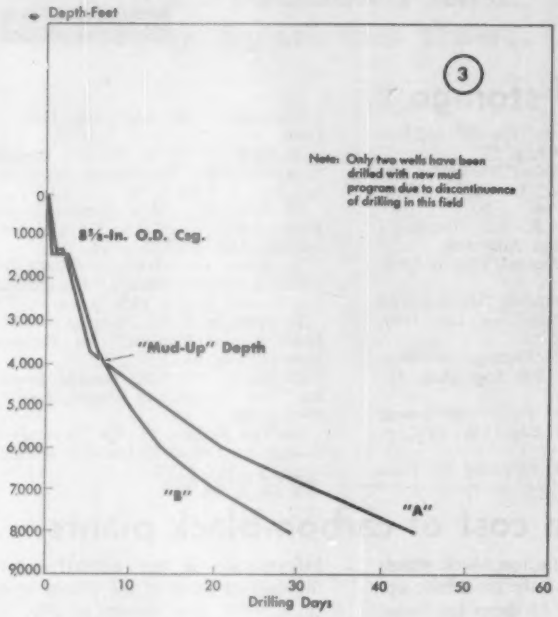
Saturated or unsaturated salt water, lb. per gal.	8.6-10
Gum, lb. per bbl.	.5- 1
Starch, lb. per bbl.	1
Preservative, lb. per bbl.	0-.25
Anticorrosion agent, lb. per bbl.	.5
Oil, vol. %	0-25
Emulsifier, gal. per bbl. of oil	.25

Typical mud properties to be expected from the mixing of the above constituents are:

Viscosity, funnel seconds	33-38
Viscosity, apparent, cp.	5-12
Plastic viscosity, cp.	5- 9
Yield point, lb./100 ft.²	0- 3
Gel strength, lb./100 ft.²:	
Initial	0
10-minute	0
Filtrate loss, ml.	10 or less

Oil content determines the amount

Goldsmith Devonian drilling comparison



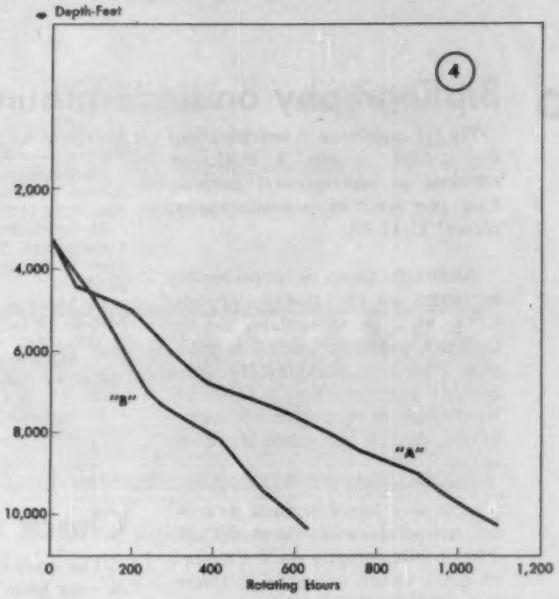
WELL	"B"	"A"
TYPE MUD	NO CLAY STARCH 20% OIL 2-3% SOLIDS	SALT WATER CLAY STARCH 20% OIL 8-12% SOLIDS
BITS	42 - 7⅞"	57 - 7⅞"
DAYS	29.5	44.5
MUD COST	$1380	$3176

Fig. 3. Goldsmith (Devonian) field, Ector County, wells have the same surface casing and mud programs as wells drilled in Goldsmith, 5,600-ft. field. Well "A" was drilled with an oil-emulsion salt-water clay mud. Well "B" was drilled by the same contractor, using similar drilling practices, with an oil-emulsion clay-free salt-water mud.

Results in this comparison show that Well "B" had:

1. A 38% reduction in drilling days.
2. A 26% reduction in bits.
3. A 56% reduction in mud cost.

Wildcat drilling comparison



WELL	"B"	"A"
TYPE MUD	NO CLAY - SALT BRINE STARCH - GUM 2% SOLIDS	LOW SOLID - CMC 6% - 10% SOLIDS
BITS	63 CONVENTIONAL 6 CHERT	79 CONVENTIONAL 4 CHERT
ROTATING HOURS	633	1085
MUD COST	$ 13,020	$ 10,220

Fig. 4. The accurate comparison of results of mud programs used on wildcats drilled by different contractors, several miles apart, is very difficult and the following results are not held as conclusive. However, the results do warrant further trials of this new mud approach.

Two wells were drilled in Terrell County and were approximately 5 miles apart. Geologically, formations were similar. Well "A" was drilled with a fresh-water low-solids CMC mud, and Well "B" was drilled with a 9.4-lb. per gallon, clay-free salt-water mud. Results show that Well "B" had:

1. A 41% reduction in rotating hours.
2. Sixteen fewer conventional rock bits, two extra chert bits.
3. A 27% increase in mud cost.

An over-all cost comparison for these two wells was made. It was found that Well "B" was drilled for $2.80 per foot less than Well "A," through the interval compared.

of gum needed for a desired viscosity. If muds using 20% (by volume) or more oil, very little, if any gum is necessary.

The cost per barrel of the original makeup of a fluid of this type is about $1.25 to $1.75. Proximity to salt brine source varies the cost more than other factors.

Daily maintenance can be extremely low when it is possible to use viscosity in the 32-33 funnel-second range. However, daily maintenance in nonemulsion muds of 38-40 funnel seconds can become very expensive compared to conventional muds. In such cases, results in drilling may be good enough to make the clay-free mud economical.

Deep-well work. The clay-free salt-water mud has been used for drilling deep wells (10,000 ft. or deeper) in only a few cases. But, to date, wildcats have been drilled with it to 13,000 ft. In Puckett field, depths of 14,000 ft. have been reached with this type of mud program.

Another application of clay-free salt-water mud is in deep wells which need a mud of near 10-lb. per gallon density to control formation pressures. In this density range, the clay-free salt-water mud contains 2% solids, or less, as compared with approximately 10-12% for a fresh-water mud. And, in this range, the difference in the drilling characteristics of these two muds would be the greatest. The clay-free salt-water mud in this density range costs considerably less because it eliminates use of commercial weighting materials.

Clay-free salt-water muds have brought outstanding results.

BY W. L. NELSON
Technical Editor and Petroleum Consultant

Questions on TECHNOLOGY

Bibliography on underground storage

We are interested in articles about the storage of oils, L. P. G., or ethylene in underground caverns. Can you send us a bibliography, please? C. H. M.

Although there is considerable literature on the storage of oils, LPG, etc., in subsurface storage facilities, not much detail is available. This fact undoubtedly arises because each situation is different. In addition to the references shown below, Ref. 9 lists many more articles.

Ethylene cannot be stored underground as a liquid because its critical temperature is about 50° F. Thus a bibliography on the storage of gases would be more pertinent. Refs. 9, 10, 18, and 26 pertain to the storage of ethylene.

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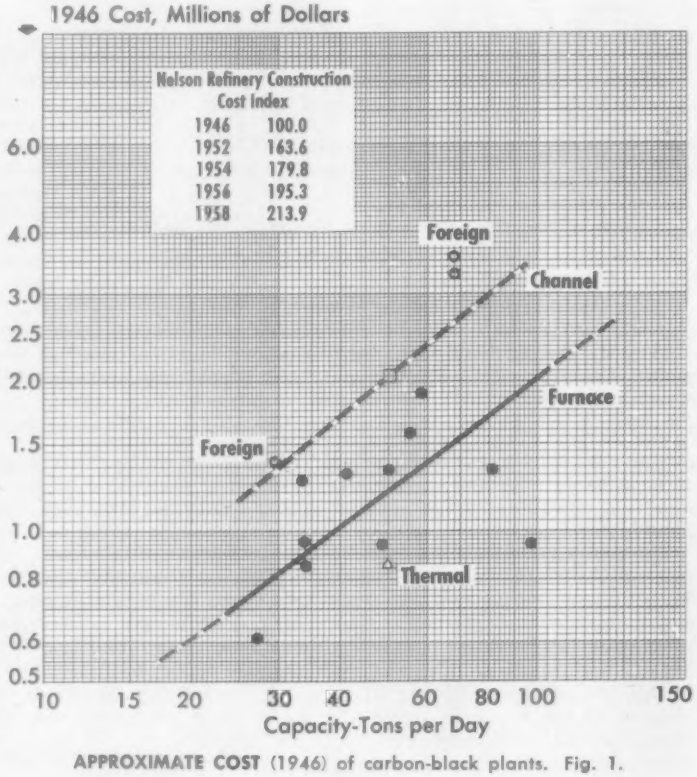
Check on cost of carbon-black plants

The costs of carbon black plants in your issue of July 20, 1959, appear to be about 10 times too large. Can you check on this please? J.V.D.F.

The costs that were published in the July 20, 1959 issue, page 89, under the title "Cost of Small Carbon Black Plants" are far too large. Information is not extensive but the cost of most of the plants built since 1958 are shown in Fig. 1. The news literature usually does not indicate the type of process, but most of the plants are thought to be the "furnace" process. Costs were converted to 1946 costs by means of the Nelson Refinery Construction Cost Index.



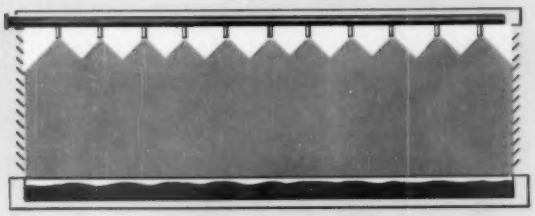
APPROXIMATE COST (1946) of carbon-black plants. Fig. 1.

Should Process Plant Cooling Systems Use..

AIR ——

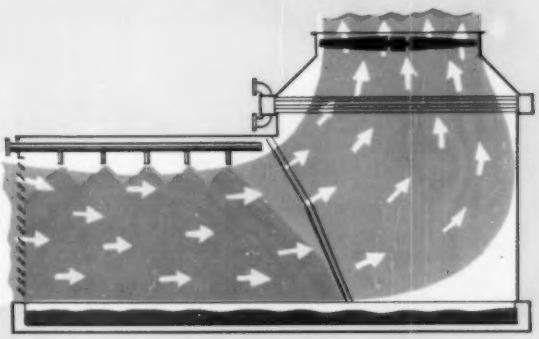
HUDSON SOLO-AIRE UNITS

WATER ——



HUDSON COOLING TOWERS

or a combination of AIR AND WATER ——



HUDSON COMBIN-AIRE UNITS

The answer is found only through comparisons of economics of air, water or a combination of the two for cooling each process stream, and incorporating the results in one integrated cooling system. Factors to be considered include desired effluent temperature of each process stream; summer and winter ambient dry and wet bulb temperatures; availability and quality of water; possibility of public water pollution; space available; and first cost, maintenance cost, and operating cost of equipment.

HUDSON is unique in supplying water cooling towers, Solo-aire units, and Combin-aire units to comprise integrated cooling systems utilizing air and water in economic ratios. With the collaboration of owners' engineers, HUDSON has designed integrated cooling systems for a wide range of process and climatic conditions. Hundreds of HUDSON installations are operating in the United States, Ireland, England, France, Spain, Norway, Saudi Arabia, Pakistan, the Philippines, Mexico, Chile, Peru, Venezuela, and Canada. HUDSON experience, available without obligation in integrating the cooling system with process design, will be most valuable to plant owners if utilized during planning stages.

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WPRA refining quiz on

PART 4—CONCLUSION

Coking, distillation, and treating

BANKS: Has anyone in the industry developed a good procedure of sampling coke from the drum in the delayed coking operation?

RATLIFF: I agreed to comment on this, but not to give an answer. The only answer we have to the question is no. We have tried a number of methods ranging from sampling an entire drum of coke as cut, to sampling by taking periodic buckets of coke at various levels in the drum as coke is being cut. I would say that our normal procedure is to sample the coke in this latter manner by getting a portion of the coke at known levels, i.e., that which comes from known levels in the coke drum. For somewhat more accurate methods of sampling coke from the drums as it was being cut, we have moved in a clam shell and taken big bites of coke from the material being cut and quartered that to get a representative sample.

BANKS: Is better coke (VCM) produced at high or low throughput ratios when you do not inject superheated steam to the coke drums?

WRIGHT: I have no actual backup data on this, but I feel that a higher average coke-drum temperature will produce lower VCM, longer drum cycles will produce lower VCM, and longer steaming during drum cooling will produce lower VCM. I suspect that if you were back off on throughput by 10 or 15% with no steam in the system, or no steam used during cooling, that little difference would be noted in VCM. But if you cut your rate 25 or 50%, I suspect the coke would have a lower VCM due to the higher average coke-bed temperature.

RATLIFF: If the lower throughput means a higher recycle ratio, then at the constant heater outlet temperature we would expect a lower VCM content of the coke due to the higher coke-drum vapor-outlet temperatures.

BRADFORD, W. H. (Standard Oil Co., Ohio): If we cannot agree that there is a good procedure for sampling coke, how much reliability do the others put on the VCM analysis?

THE PANEL

W. L. Banks, Moderator
WPRA Technical Director
Tulsa

P. G. Wright
Mobil Oil Co.
East St. Louis, Ill.

R. W. Kersey
Derby Refining Co.
Wichita, Kans.

R. A. Ratliff
Continental Oil Co.
Westlake, La.

R. G. Alexander
International Refineries, Inc.
Wrenshall, Minn.

W. F. Johnston
American Oil Co.
Texas City, Tex.

G. M. Rose
Tidewater Oil Co.
Delaware City, Del.

O. J. Zandona
Ashland Oil & Refining Co.
Ashland, Ky.

G. F. Adams
DX Sunray Oil Co.
Tulsa, Okla.

J. E. Harrell, Jr.
Universal Oil Products Co.
Houston, Tex.

W. L. Vermilion
The Standard Oil Co.
Cleveland, Ohio

P. S. Verity
Foster Wheeler Corp.
New York, N. Y.

WRIGHT: You have to do the best you can with what you have. We cut our coke directly into gondola cars, so we have available to us a way to get a representative sample of our coke bed. The VCM varies throughout the bed. Generally at the top it's higher, and at the bottom it's lower. I think you have to look at the average system.

RATLIFF: For purposes of control, we find that the methods of sampling by taking the small samples at given points of bed depth are accurate enough to be correlated for control of our operations.

EPPARD, J. H. (DX Sunray Oil Co.): We decoke our drums into a basin then use a Sauerman drag line to pull the coke into a storage pile. From this pile we load into railroad cars with a clam shell. We then sample the railroad cars once per week. Recently we compared the analysis we obtained from these samples with those made by the purchaser of the coke who samples each car and makes a composite. The two analyses checked relatively well. The VCM varied a lot, but the sulfur and ash gave a good check. This compares a spot sample with an elaborate composite system and probably works since our feed is relatively constant.

BANKS: Does anyone have a hardness test on coke? If so, what does it involve?

WRIGHT: Our research people have been looking at this type of thing. I would like to emphasize that we do not have the test in the refinery. We've looked at something called the Hargrove grindability index which has an ASTM No. D 409-37. As I understand it, this is based on Ritlinger's Law, where the work done in pulverizing is proportional to the new surface produced. The base was coal, with an index of 100. And the test, briefly, is to take a 16 to 30-mesh sample and grind it in a standard apparatus. The per cent of material that passes into a 200-mesh screen is

obtained after grinding. The index then is equal to 13 + 6.93W, where W equals the per cent through 200 mesh.

We have some correlations from our Paulsboro coker; 13 to 14-VCM coke with a 900° to 917° F. furnace outlet, 24-hour drum cycle, had index from 89.2 to 96.2. With a 10-12-VCM material, a 920° to 922° F. furnace outlet, and a 24-hour cycle, the index varied from 74.3 to 82.9. I think that you can see from this that the lower the index the harder would be the coke. Other data from our Trenton coker, with a 12.4 VCM and 915° to 920° F. furnace outlet, but on a 16-hour drum cycle, show index to be 105.7. Those are high-pressure cokers, operating around 60 lb. We've also looked at the Ball Mill test which had ASTM No. D-408-37. It correlates with the Hargrove grindability index.

RATLIFF: We use a friability test which gives an indication of the hardness of the coke. This is a modification of the friability test used for determining the friability of catalyst. It involves crushing some of the coke and taking a sample of that retained on a ¼-in. screen and which will pass through a ½-in. screen, and rolling it for 30 minutes in half-gallon can with steel balls. This is purely an empirical test as far as we're concerned, but it does give us a reference of the hardness of the coke we are making and, consequently, the amount of fines that we can expect. After this material has been rotated in this can for 30 minutes, the amount retained on a No. 6 mesh screen is measured and this amount is the friability index. Most of the coke we make will run in the neighborhood of up to 90%.

BANKS: Has anyone installed coke traps in a coker heater charge line? If so, how has heater operation been affected?

WRIGHT: Our General Petroleum refinery was having some trouble. Their pump suction line to the furnace comes off the side of the fractionation column, about 3 or 4 ft. up from the bottom. At one time they were filling up this bottom dead portion in the column with coke-fines. Occasionally the fines would spill over into a suction of their pump and cause the pump to seize. This would coke up the furnace. They installed a circulating line with two parallel filters off the bottom of the column, pumping back into the side of the column. They feel they have been successful in reducing this type of failure. However, we keep hearing rumors that people have put this type of filter in a heater charge line.

ADAMS: We have suction screens on the pumps on one of our coking units and on the other one we have a screen in the bottom of the tower to catch larger particles of coke to keep them out of the pump. I imagine coke fines on our type of unit where the suction is right from the bottom of the vessel would be pumped right on through the pump and into the heater, if they were disposed of as they come through rather than allowed to build up where they might sluff off in large amounts.

WRIGHT: One of our problems here is during startup. There seems to be a great deal of loose coke left in the system. Our heater charge pump has a coke-crusher-type impeller which I feel is quite successful. And it can handle quite large chunks of material passing through the system. But if this material sluffs off during the startup, it can cause the pump to fail, or plug up a header box in the heater. That is one reason we were curious if anyone is filtering their heater charge line.

BANKS: What methods are used to recover the heavy oils that originate from delayed-coker blowdown and how are these oils disposed of?

VERMILION: I can state what our method is, and I think it is fairly standard. The coker blowdown is put through a water-box cooler and then the recovered oil is recharged to the unit.

RATLIFF: We have a slight modification. Actually, we use a small pump to pump the oil from the blowdown pond. This pump has a maximum capacity of 10 g.p.m. This is pumped directly into the fractionating tower.

Distillation

BANKS: What is being done to alleviate FCC debutanizer reboiler fouling and corrosion? Is anyone using aluminized tubes?

ADAMS: We don't have a problem with cat debutanizer reboiler fouling, and I would suspect that somebody who does have a serious problem is carrying a considerable amount of water into the tower. The best solution would be to eliminate water from the debutanizer feed. The means of doing this would depend on the type of gas-recovery system preceding the cat debutanizer.

HARRELL: Certain types of corrosion inhibitors, we find, will cure this problem. There have been times when we thought it might be necessary to go to Polyflo 100, dispersing-type additive, to cure the trouble, but Unicor or Unicor LHS accomplished the purpose.

BANKS: How do you evaluate visbreaking? Is anyone visbreaking cat main fractionator bottoms?

McFATTER, W. E. (Cities Service Refining Corp.): We made a run on our visbreaker unit, using as feed stock a fractionator bottoms of roughly 5° API, and a low-viscosity material. Up to 950° we got essentially zero conversion.

MADDOCK, W. T. (The Ohio Oil Co.): The evaluation is a little bit awkward because we have to get rid of the bottoms. We are actually doing more than a visbreaking operation. We are thermally cracking the material. We've had good operation with it, and we end up with about 45 to 50% bottoms suitable for No. 6 fuel oil, with a viscosity of 250 S.s.F. at 122° F., and about 35% gasoline.

WRIGHT: In 1953 or 1954, when we were a little short of catalytic cracking capacity, we used to gas-oil crack this material. We hit it very hard and made a thermal gasoline out of it and a No. 6 fuel. Before the operation ended up, we put the No. 6 fuel into the coker. Depending on your own refinery's economics, it can look like a good charge stock. It cracks well. It was mostly coke and gas-oil and very little gas and gasoline. We operated at recycle ratios of around 3 to 1, based on fresh-feed intake to the unit, and as I recall, the furnace outlets were held at 750 psig. and 900° F.

ADAMS: We have coked cat fractionator bottoms as a separate feed stock to the coking unit, and we can supply information if there is any interest.

VERITY: Has anyone information on the vapor velocity allowable in the coke drum? We found that a unit operating at 0.35 ft. per second gave us considerable trouble, and at 0.25 ft. per second we had no trouble at all. By trouble, I mean carryover into the transfer lines, and into the fractionator, and I wonder if anyone else has any figures on allowable velocity in the drum.

This is Part 4 of the 1959 WPRA El Dorado, Ark., question-and-answer refinery meeting report. Part 1 on cat reforming appeared in the March issue. Part 2 on cracking appeared in the April 4 issue. Part 3 on alkylation, control, instrumentation, and polymerization appeared April 11.

WRIGHT: Our unit was designed for a superficial vapor velocity of around 0.2 ft. per second, and we did not have much carryover into the overhead lines, with the exception of drum pukes. If we were operating at high outages—in other words, low coke make—those lines ran relatively clean. As we increase the throughput, the lines get dirtier. We recently expanded the coker to a three-drum operation, operating on a 16-hour cycle, and the material in the overhead lines (our velocity is now around 0.26 or 0.27) is definitely heavier for the same outage levels.

We used to try to reduce our foam height by raising the temperature on our furnace outlet. We've found that at the higher velocities it is more difficult to do. The temperature has much less effect on the height of the froth, or foam, in the bed.

VERITY: Was it sufficient to shut down at 0.26 ft. per second, or did you get reasonably good runs?

WRIGHT: We're set up so we can clean the overhead lines on stream. We had to go back to cleaning them every other week — something like that.

CHAVES, WILLIAM (DX Sunray Oil Co.): What was the effect of the furnace outlet temperature on the yield of gas-oils?

WRIGHT: I think it has no effect on the gas-oil yield. As far as the oil is concerned, it spends infinite time in the soaking drums. I don't think you can vary the gas-oil yield with the furnace outlet temperature.

BANKS: A propane-butane splitter tower has a horizontal kettle-type reboiler. The butane bottoms product is drawn from an overflow compartment at one end of the reboiler and flow of this stream is controlled on the reboiler compartment. On several occasions the tower has filled with liquid even while maintaining a proper level in the reboiler. How can this be explained?

WRIGHT: I suspect that the line from the tower bottoms to the reboiler is too small or has restriction in it. The head required to push his boil up and product into the reboiler is probably causing too much pressure drop and he's building up the liquid in the tower and flooding it. The other possibility that occurs to me is an obstruction or downcomer restriction in the bottom portion of the tower which can act in the same manner.

VERMILION: It is also possible to flood the upper tower without having too much effect on the bottoms section. You can flood the entire upper section and carry liquid over and still think from the bottom of the tower that the thing is operating properly.

ZANDONA: There is another point of importance with respect to tower design which is based upon the reboiler vapor return to the tower. Often little concern is given to the orientation of the reboiler return and it is allowed to impinge on the downcomer on the bottom tray. If this happens, there is a good possibility that vaporization will occur in the bottom downcomer and restrict tower capacity. We have had several occasions when it was necessary to insulate the downcomer or put a deflector plate on the reboiler vapor return. In addition, it is rather difficult to come up with an exact method of sizing the liquid line to the reboiler. There has been a tendency in the past to make this line too small. It is important to size the reboiler liquid line liberally.

VERITY: Methods of sizing reboiler lines must be very generous indeed, and must take elevations into account. In some cases the tower is not high enough above the reboiler to get proper circulation after a certain amount of corrosion and accumulation of dirt and one or two other things, and it can start giving trouble.

BANKS: What method is used to control the side drawoff streams on fractionation towers such as a crude unit?

VERITY: Foster-Wheeler's normal custom has been to have the flow-recorder controller on the stripper bottoms and a liquid level controller on the side stream drawoff controlled by the level in the stripper. I think that the more sophisticated method mentioned in the question might easily overtake the old-fashioned one. Does anybody use such a method of temperature control on fractionating towers direct?

ALEXANDER: We have operated our strippers flooded on occasion when we had the level instrument feeding the stripper go out over a weekend. Rather than call somebody out to fix it, we just operated it flooded and were able to make flash very nicely on a No. 2 fuel oil.

KERSEY: We have a simpler method of controlling the side drawoff streams from a fractionator which has proven quite satisfactory. We found that, when controlling the feed to a stripper by a control valve located on the line to the stripper, it was very easy to get into a vicious cycle between the valve and the level controller on the bottom of the stripper. We now use an air-loaded control valve located on the feed to the stripper, operated from a hand-operated loading station in the control room. Level controller on the stripper then controls flow out of the stripper to storage. A flow recorder is installed on this line. A thermocouple is installed at the point of draw from the main fractionator. By observing this temperature, and laboratory results, changes can be made as necessary to control the quality of the stream.

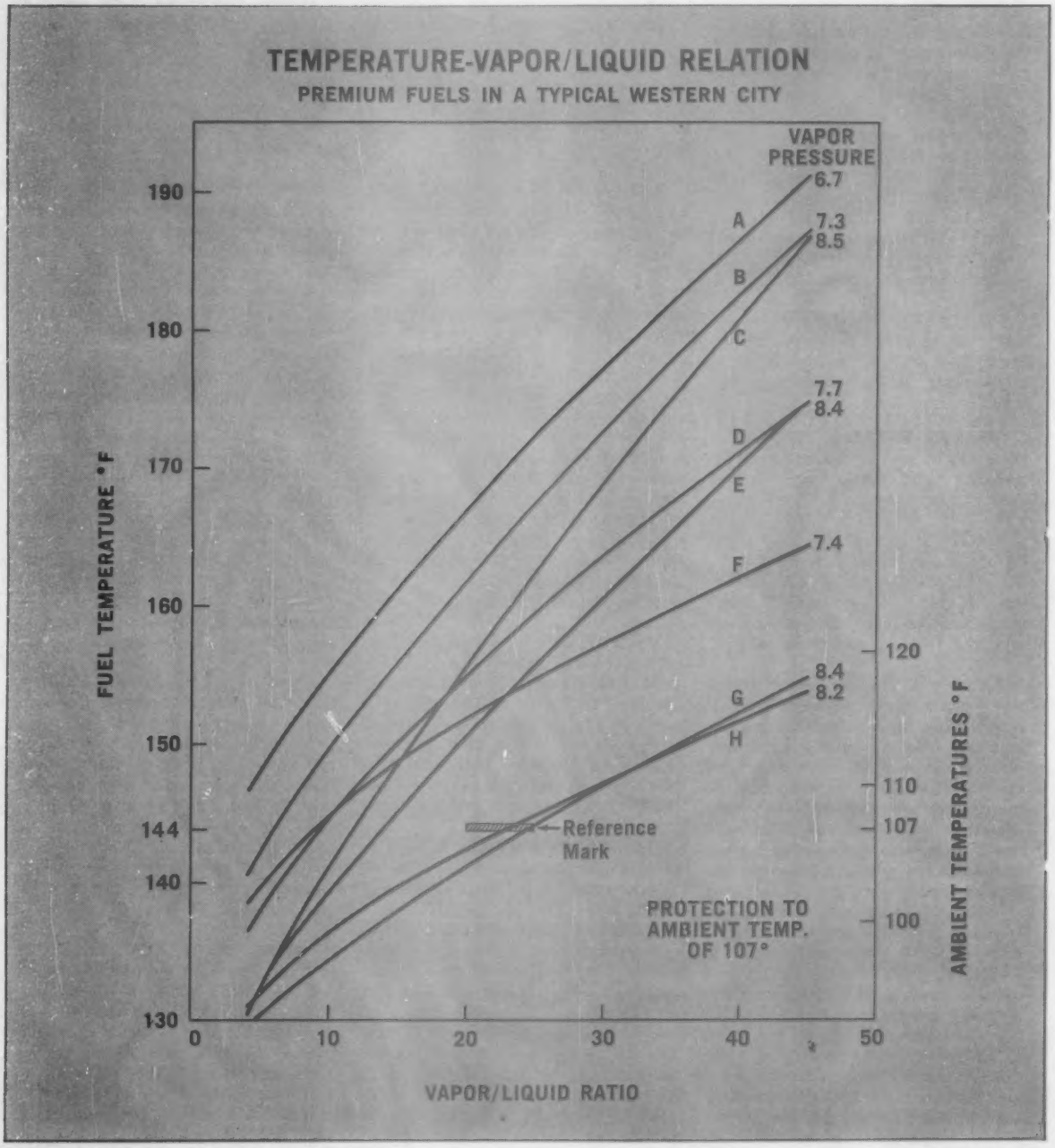
CURRIN, C. B. (Atlantic Refining Co.): Has anyone tried using continuous analyzers on a side stream, such as a middle distillate or solvent-type cut where you want to control both front and back end? For example using a flash analyzer to control the split between the product and the cut above it, and using an end-point analyzer to control the draw rate of the product to closely approach an end-point specification?

deLOOPER, HARRY (Texas City Refining, Inc.): In the past few weeks we have been taking a solvent cut. Controls include rate of flow to storage, with the level in the stripper controlling the draw from the tower. We have been taking a very close cut; in fact it's a range of just about 100° F. It also has a 100° F. minimum flash. Our finished tanks are 312° F. initial, 408° F. e.p. and a flash of 102°

Here's a practical method for analyzing Front-End Volatility

Ethyl Research uses temperature-vapor liquid ratio curves to study relative and absolute front-end characteristics of gasoline

by **GILBERT WAY**—*Research Representative*



The above curves were calculated by the CRC method using Ethyl Volatility Survey data.

WHERE TO SET front-end volatility for optimum balance of economic and automotive benefits is an important question for refiners.

One result of Ethyl's work in this field is a routine approach to interpretation and comparison of seasonal volatility data. The method can be used to establish or review volatility requirements at both the refinery and marketing levels. Data from the Ethyl Volatility Survey are used as the basis for temperature-V/L studies. *Refiners may have analyses of their own marketing areas upon request!*

Method is Simple; Easy to Understand

Temperature-V/L ratio curves—widely accepted as a graphic representation of how gasoline vaporizes in a fuel system—are used to show the volumes of vapor formed per volume of liquid at any given gasoline temperature. (Curves were calculated by the CRC method.)

In addition to showing relative vaporizing tendencies among various fuels, the curves may be related to reference points that indicate average conditions of fuel temperature and limiting V/L in automotive fuel systems. In the accompanying graph, average conditions for premium fuels are shown by the reference mark ranging from 20 to 25 V/L at a fuel temperature of 144°F.

This reference mark range was established from the results of extensive road tests conducted in recent years. Many factors were considered in arriving at this practical bench mark, such as severity of test conditions, age and condition of fuel system components, and variation of individual cars from average characteristics.

In theory, a fuel having a curve which passes through the reference mark would represent highest desirable use of front-end "fill." Those above the mark would be more conservative and those below subject to vapor lock.

The estimate of fuel temperature was established by adding the temperature rise at the fuel pump under severe vapor locking conditions and the ambient temperature to which protection against vapor lock is desired. Experience has shown that this fuel temperature rise at the pump averages 37°F. In the marketing area represented in the graph, protection is desired up to 107°F.

Some Interesting Observations on Volatility

The figure shows a wide variation in vaporizing tendency of fuels. Fuels A, B and C indicate a conservative position. This is contrasted by high volatility and border line protection against vapor lock by curves of fuels G and H.

Curves having steep slopes are typical of fuels pressurized by butane. Those with flat slopes indicate a high pentane content. Fuels C, E and G have essentially the same Rvp of 8.4 to 8.5. They converge at a V/L of 4, the V/L of the Reid vapor pressure bomb.

A V/L of 25, however, is reached by fuel G at a fuel temperature of 144°F., whereas fuel C must reach 163°F. before evolving the same quantity of vapor. Thus fuel C offers more protection against vapor lock than fuel G when abnormally high temperatures are encountered. This illustrates that, *for a given Rvp, butanized* fuels offer greater vapor lock protection in motor vehicles than fuels that are pressurized largely by pentane. Another way of comparing these two fuels is at constant temperature: at 150°F., fuel G has 35 V/L, fuel C only 16.

How Ethyl Research can help you

In addition to participating in Oil Industry cooperative studies, Ethyl Research has worked with many individual oil companies in studies of vapor locking tendencies of fuels and engines.

The experience gained in these programs provides a broad understanding of the problems associated with front-end volatility.

Our engineers are prepared to bring you analyses of Temperature-V/L characteristics of fuels from marketing areas of your choice, based on Ethyl Volatility Survey data. For overseas areas where Survey data are not available, studies can be made for refiners who supply sample inspection information.

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F. What we have been doing is taking an end point controlled by rate of flow and adjusting the gasoline to give us flash by tower-top temperature controller, using a maximum amount of steam in the stripper and tower.

The only way we could get the actual cut was by varying the draws. We have three different trays we can draw from. After establishing the proper tray from which to draw, we have been able to make a close-range product. It's a pretty tricky operation, and you have only to touch your valve to make volume changes. The valves in our lines are very large and when making a solvent cut we take out the control valve and install a 1½-in. valve in its place. The rate of flow is then controlled by hand.

Extreme care must be used in the amount of steam used for stripping, especially in the gas-oil stripper. The heater-outlet transfer temperature is adjusted with each crude-charge change, based on the gravity of the crude charged.

NOLLKAMPER, L. M. (Cities Service Refining Corp.): How do you control butane products or side-stream products quality on the alkylation isobutane-stripper tower?

KERSEY: We draw a butane side stream as a vapor from a point a few trays above the bottom tray of the isostripper column. This is done by means of a flow-recorder controller on the liquid product after the condenser and scrubber. By watching temperatures in the column and laboratory analysis on the butane stream, we can set conditions to minimize isobutane loss while controlling R.v.p. of the alkylate. We normally run around 93-94% normal butane in this stream with the balance isobutane and C_5 plus.

BANKS: We would be interested in any information users of Glitch ballast trays can give as to (1) capacity in relation to Flexitrays and bubble-cap trays, (2) relative fouling tendency compared with Flexitrays and bubble-cap trays, and (3) any other characteristic of ballast-trays either good or bad.

MADDOX, R. J. (Texas City Refining, Inc.): I can't answer this question, but I just saw a digest of an AIChE meeting that was held in New York in which the question was answered. Mr. Hausch of Shell Oil gave a paper on it.

BANKS: We have a problem of thermal stability in No. 6 fuel oil, as evidenced by an increase in b.s. and w. content. What is the practice used by others in storing No. 6 fuel for shipment, in terms of storage time and temperature? Are suction heaters an answer to this problem? What test methods are available for evaluating the thermal stability of No. 6 fuel oil?

ADAMS: I remember a case or two where blending thermal residuum with virgin residuum resulted in a very rapid increase of bottom sediment content in storage. Perhaps that might be the problem in this case.

HARRELL: UOP recommends trial of dispersant additive, Polyflo 100, on these fuel oils. Dosage of 20-40 p.p.m. by weight disperses polymer and wax formations.

ZANDONA: Instability in fuel oil, if it is manufactured through the use of visbreaking, is probably caused by high temperatures in the visbreaker operation. High severity of visbreaking a paraffinic stock creates a tendency toward instability of fuel oil while in storage. That is, the b.s. and w. actually increases from one day to the next while the material is in storage. The only thing that has been found to stop this is to go back to the visbreaker and reduce heater temperatures. UOP has a stability test in the laboratory manual which would give some indication of the stability of the oil leaving the visbreaker, and by making proper adjustments to your visbreaking unit, you would probably be able to solve your problem.

VERITY: If you measure the degree of visbreaking by viscosity reduction, then I would say the higher the temperature the better. Low soaking time and high temperature are best for a given viscosity reduction. Maximum permissible reduction for a paraffinic stock, of course, is much less than for a naphthenic. Once or twice we've been able to solve fuel-stability problems by using hot blending rather than cold. Sometimes quite high temperatures are required.

MARDAGA: Even without visbreaking, I have noticed that with certain rare combinations of highly asphaltic residuum and a very paraffinic low-boiling flux stock, you can get what amounts to a creeping deasphalting reaction in storage. This sometimes is more pronounced on No. 4 and No. 5 fuel than No. 6 fuel oil. That could be a cause for the problem, and it may have less to do with storage temperature than selection of components.

BANKS: What will the olefin limitation on the West Coast do to the gasoline formulation and do you see this type of specification becoming more prevalent?

EMERSON, H. R. (Union Oil Co. of California): The olefin limitation referred to is probably that known as Rule 63, which applies to Los Angeles County only. This rule or county law states that after July 1, 1960, the bromine number of motor gasolines shall not exceed 30; and shall not exceed 20 after December 31, 1961.

The issuance of Rule 63 was based on work carried out by the Los Angeles County Air - Pollution - Control District, purporting to show a relationship between olefin concentration in auto exhaust and olefin concentration in gasoline. Exhaust olefins are major suspects in smog formation. At present, the LA-APCD and the Western Oil & Gas Association are jointly doing research to more definitely establish this relationship. Some evidence indicates that alkylate in the gasoline is as bad or worse than gasoline olefins as the former is partly converted to olefins in the engine and exhausted as such. Aromatics appear to produce less smog-forming exhaust than do olefin or alkylate fuels. The final answer is not yet available.

If the joint research effort supports the earlier work, Rule 63 will become effective and will probably be adopted by other counties within the smog-ridden Los Angeles basin. Further adoption of the ruling by other communities will depend on local conditions; for example, San Francisco still considers industry and not automobiles to be the prime causative agent of smog.

BANKS: In what fields do you think molecular sieves or selective adsorbents have application and give order of preference?

CLARK, EDWARD L. (Linde Co.): The fields of application of molecular sieves in refinery operations are:

1. Dehydration and desulfurization of LPG.
2. Dehydration of benzene, toluene, and xylene products.
3. Dehydration of naphtha feed to a reformer.
4. Dehydration of HF alkylation feed.
5. Dehydration of transformer oils.
6. Dehydration and purification of feed butane for butane isomerization.
7. Removal of hydrogen sulfide,

mercaptans, and sulfides from various liquids.

8. Dehydration of recycle reformer hydrogen.

9. Dehydration and purification of reformer hydrogen used as synthesis gas.

10. Dehydration and purification of inert gas.

11. Selective adsorption of normal-hydrocarbons to: (a) improve fuel octane, (b) produce superior jet fuel, and (c) produce preferred straight-chair cracking stock for petrochemicals.

BANKS: To what extent have molecular sieves been used in gas drying operations in refineries? Other applications?

CLARK: Molecular sieves have been used fairly extensively for the 11 typical applications, except applications numbered 4, 8, and 11. Extensive design and test work has been done on these three applications, and commercial installations are expected sometime during 1960.

BANKS: What new inhibitors are being used for corrosion inhibition in gas-recovery systems?

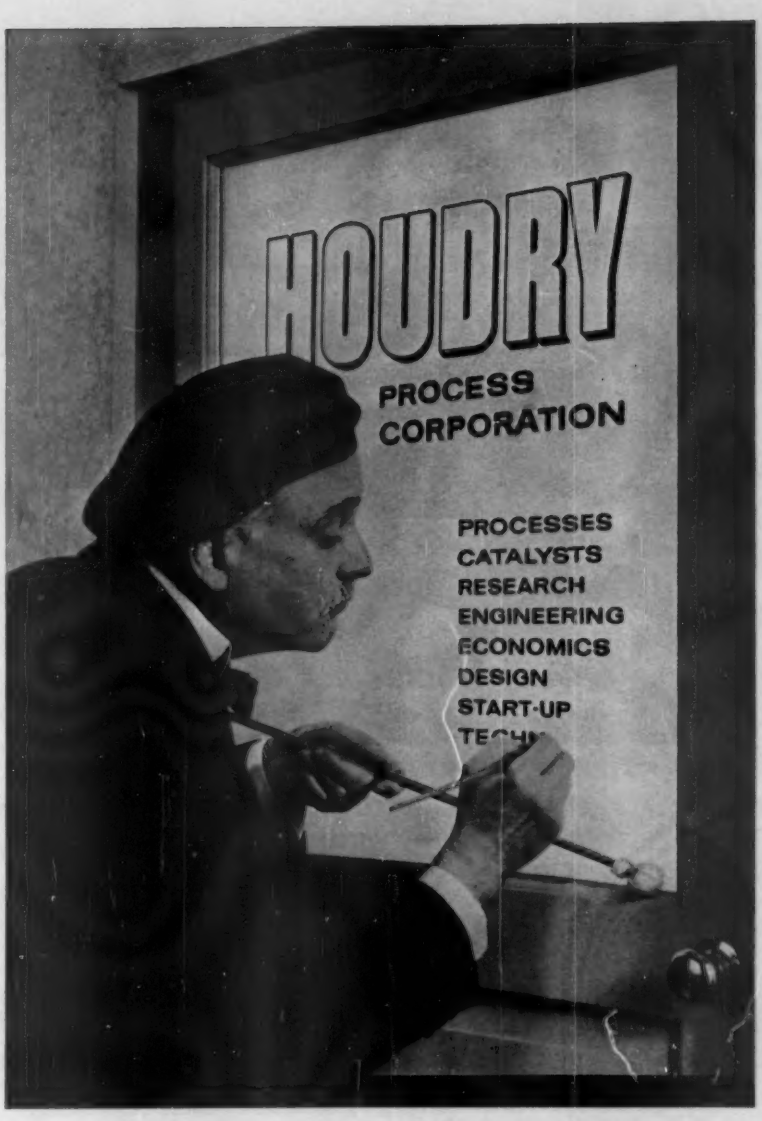
HARRELL: UOP uses Unicor LHS and have had good acceptance over the past 2 years on gas con systems.

CORNELI, PHIL (Tretolite Co.): We've developed a compound, Kontol-157, which has shown excellent oil-solubility in light-hydrocarbon streams. We've tested it in depropanizer overhead streams where it has shown good solubility. And we feel this solubility lends itself to good distribution especially in gas-recovery streams.

BANKS: Has anyone ever encountered emulsification of caustic and butane-butylenes (BB) when no more than 20 p.p.m. filming amine inhibitors have been injected into the BB?

HARRELL: The answer probably is yes. This is a border-line area for the more potent inhibitors. Be sure the inhibitor you use has good solubility in liquid BB and does not build up the inhibitor content in the caustic drastically. Do not use a caustic too long or make the treating mix unduly intimate. There are other causes, but these can be the most prevalent.

When you run a process stream with the corrosion inhibitor in it through the caustic wash, some of the corrosion inhibitor can be removed, and will stay in the caustic wash. In other types of caustic scrub-



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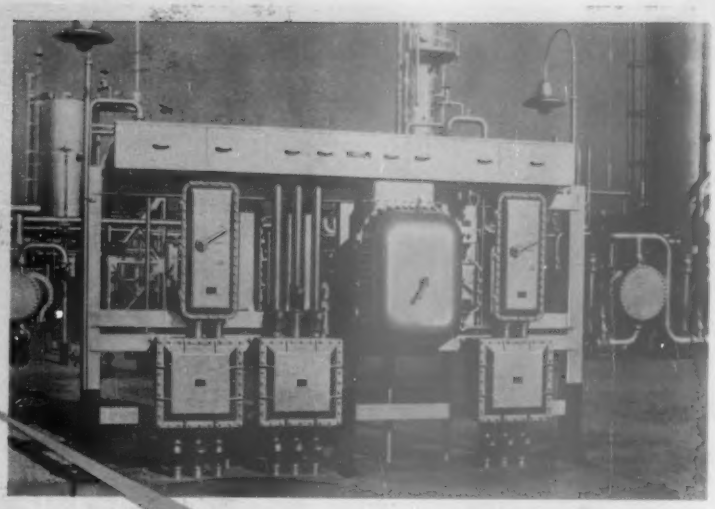

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bing you have other ways to be guided. For instance, in cat gasoline caustic scrubbing you have organic acids, or perhaps you run strengths on your caustic. But on BB caustic in a lot of cases where it may not contain hydrogen sulfide, you may be prone to use BB caustic too long. To that extent corrosion inhibitor could build up over a long haul.

BANKS: Some refiners find it advantageous to solvent extract heavy-cycle oil for feed to catalytic cracking units. What is the disposition of the extract?

ADAMS: This stock would undoubtedly have all the properties for sale to somebody for the production of carbon black. It would be a very aromatic stock, have a high carbon-to-hydrogen ratio, low specific gravity, and low viscosity. If it weren't sold for that purpose, probably it would have to be used as fuel-oil blending stock.

Desalting

BANKS: What is the experience of various refiners using Cronox C to replace or augment crude desalting?

MADDOX: In our opinion, which we believe is shared by Aquaness, Cronox C does not replace desalter equipment. There may be some low-salt-content crudes which could be economically treated, but for the most part, treating cost will be prohibitive in higher salt crudes.

We now have 1 year of experience on two topping units. One unit was in service for 1 year before starting Cronox C, and one unit was in continuous service following its last turnaround. It is our opinion that the following benefits were realized, at the very least: (1) savings in replacement of furnace tubes, (2) savings in cleaning costs of crude heat exchangers, and (3) decrease in corrosion in gas-oil section of tower due to neutralization of naphthenic acids.

It was the opinion of our maintenance people that the use of Cronox C directly eliminated the need for replacing 36 tubes in one heater. This is due partly to decreasing corrosion, and partly to eliminating tube fouling, and hence impingement due to harder furnace firing.

On both units the reduced crude-to-crude exchanger is the last one in the crude train before the heater. Before the use of Cronox C, the crude side (shell) fouled badly with hard material which was difficult to clean. The amount of fouling material has been materially reduced, and the bundle is now very easy to clean.

The reduced crude side (tube) was also much more easily cleaned this time. Very few tubes were plugged, as compared with a large number before the use of Cronox C. The combination of results has meant that this one bundle can now be cleaned in less than one-third of the time previously required. The next exchanger upstream from the reduced crude exchanger was quite clean during this shutdown.

We are most delighted with these results. Treating cost is reasonable, and we believe the results have paid out the cost of the facilities. Atlas Powder (Aquaness) published a brochure in which they quoted a cost of $1.00 to $1.50 per thousand barrels. Our experience to date is about $1.10, excluding cost of a small amount of ammonia and Nalco 161, both of which are used for supplemental protection of overhead equipment.

ALEXANDER: When you are using Cronox C you don't have to use ammonia in your crude tower overhead?

MADDOX: We do not absolutely have to. We have found, however, that for most of our operation, it is more desirable to use about 75% of the dosage recommended by Aquaness and effect good neutralization of acids and some sulfur conversion. When we're doing this, we will see about 6.0-6.5 pH on the overhead water. We supplement that with a little ammonia to keep it up around 7.0.

Most of our operations are on fairly sweet crudes, coming primarily from the Gulf Coast. Sulfur content averages only about 0.3%. However, naphthenic acids are rather high in some of these crudes. During the times that we rerun slop oil from field and stream recovery, we normally increase our Cronox C injection rate to handle acidic oils that have accumulated from the gathering system. At that time, we use at least 100% of recommended dosage, and we normally find no need to inject ammonia. We keep a close check on pH, however, to be sure that it is not needed.

We are basing our condenser-protection controls primarily on corrosion probes. These have shown that protection beyond that given by Cronox C and ammonia can be effected by the use of Nalco 161. We think we can establish optimum levels for all three, but we believe the best protection can be achieved by leaving the

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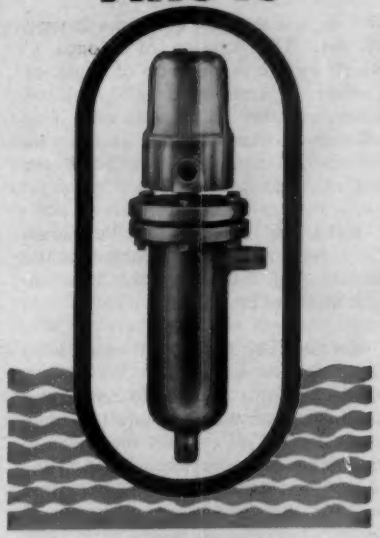

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161 in, whether the ammonia is used or not. The solution of Cronox C which we use is made up of 8 gal. of Cronox C compound, 850 gal. of water, and 900 lb. of soda ash. This solution is then injected at the rate of 0.5-0.75 g.p.h. per 1,000 bbl. per day of crude.

KILLEN, JAY (Sohio Petroleum Co.): How much of a problem is the handling of this soda ash? How do you mix and inject, etc.?

deLOOPER: It doesn't seem to be too much of a problem. We have a small platform with a foamite fixer used the same way you inject foamite and water. You connect the water to this mixer and pump through it. While water is pumped through the mixer we add the soda ash and Cronox C in the top and it mixes very well. This mixture flows into a drum; then we circulate the drum for about 20 minutes. It takes only about 30 minutes to make up a batch that will last us a day and a half. While making a new batch, we continue to charge the unit with water, Cronox C, and soda-ash mixture from a smaller drum. This drum is also used to check our rate of flow occasionally.

ZANDONA: Have you attempted to make an evaluation of the Cronox C through injecting soda ash without the Cronox C?

MADDOX: We have been trying to do that. It is a little bit difficult with the lab facilities that we have, but we hope to try this approach in the next year. The newest brochure that Aquaness published has a technique for determining ahead of time what kind of formulation you should have, based upon both sulfur content and acid number of crude oil. Until now, we haven't been able to run those analyses because of lack of a suitable potentiometer in our lab. We've had to depend on end-point colorimetric titration for some of these tests, and it just does not work satisfactorily.

BANKS: Has anyone used a desalter as a means of disposing of spent doctor, caustic, or other sour waters? If so, have any contaminants carried over to other sour waters? If so, have any contaminants carried over to other units?

KERSEY: We have used our desalter for disposal of spent caustic from treating cat cracked gasoline. We had increased corrosion rate in our primary tower after starting this addition. Whether this is incidental to the spent caustic or not, we don't know. But we discontinued the use of it because a market developed for the spent caustic.

We're now putting all of our sour water from the crude unit and the cat cracker directly to the desalter. This is done in our case for sulfide and ammonia reduction. We have tried to run a sulfur balance on the operation and the results have been inconclusive. It is pretty hard to tell just what is happening. But this operation has given us an opportunity to set up a subsequent operation whereby we spray the hot desalter effluent into an old cooling tower and as the superheated water flashes to steam, we reduce materially the content of sulfide and ammonia in this water. It has reduced our treating problems in a waste-treating plant to an acceptable level.

ALEXANDER: We are just starting to use accumulator water from our cracker, our gas plant, and our crude unit, in our desalter. The Tretolite people ran tests on it for us, and they said it should give us no problems. We have been using poly-spent caustic (final caustic wash on the poly feed) in our desalter for some time and find it works just fine.

We are trying to get rid of some of the phenols and trying to reduce the volume of water which we have to treat in our waste-disposal system. Instead of having desalter water and accumulator water, we've got only desalter water.

ZANDONA: The API committee on disposal of refinery wastes (CDRW) has canvassed the industry, and there are a number of refiners who are doing this. The primary reason for putting desalter water into the crude desalter is for the removal of phenols, thus reducing a waste-disposal problem. Most desalter waters—cat cracker accumulator waters—are stripped of hydrogen sulfide and ammonia, prior to being used in the desalters. There are a few plants that inject foul waters directly to the desalters without stripping. The information on the operation and the extraction efficiencies are reported in CDRW minutes and available to member companies. In general, approximately 85 to 95% of the phenols present are extraction by the crude.

BANKS: At what point can a refiner justify the installation of desalting equipment based on the salt content of the incoming crude?

ADAMS: We feel justification is based on reduction in maintenance of downstream equipment, not on any particular break-point in salt content in the crude.

VERITY: It has become our company general practice to recommend desalting in most cases. It seems to do good even when you don't have a great deal of salt. There always seems to be salt tomorrow even if there isn't salt today.

ROSE: Is anyone here scrubbing liquid propane-propylene streams with MEA, and if so, have they had any trouble with solubility losses or emulsification problems?

ALEXANDER: Great Northern, at St. Paul, is doing it. As far as I know they have had no particular problems with it.

Desulfurization catalysts

BANKS: Deactivation of desulfurization catalyst proceeds very slowly, but is restored by regeneration. Has anyone regenerated desulfurization catalysts where activity was not restored? If so, how many regenerations were made before evidence of permanent deactivation appeared? What caused the deactivation, loss of surface area, metal contaminants?

VERITY: In our experience, catalyst replacement is usually required by an excess pressure drop due to scale accumulation and attrition rather than by deactivation. In some cases we've found that the channeling which occurs with the excess pressure drop and the polymer deposition that also goes with it, will look like deactivation. As far as we can make out, this catalyst is so rugged that it is practically impossible to deactivate it, except by excessive temperatures in regeneration.

YEATMAN, R. N. (Atlantic Refining Co.): At our Unifining unit, using Bromine number as a basis, we started out with a 90% removal at 640° F. reactor inlet. We ended up 72% removal at 670° F. and 240 bbl. per lb. cat life after eight regenerations.

ZANDONA: Has anyone been able to determine the equilibrium coke or the coke content of the cobalt moly catalyst before regeneration?

WRIGHT: We sampled the catalyst from a reformer pretreater after coming down, without regeneration. On

"On comparing the two catalysts, we feel there are more fines in the extruded catalyst bed.

those particular samples we had 8% coke.

ROSE: We've regenerated three of our trains which use Hydrobon Type S-3. The first one was a train desulfurizing virgin gas oil, accumulating 96 bbl. per pound in about 684 days of operation. We burned off about 10.4% carbon equivalent. On train 3, which is our heavy cat naphtha treater, we burned off at 86 bbl. per lb. in 634 days. Here we distinguished between what we thought was carbon and what we thought was sulfur, 5% carbon and 5.4% sulfur. You can take those with a grain of salt, because we did them by a very rush method. On Train 5, which is our light coker, light cat gas-oil, and coker gasoline, we had 21.5 bbl. per lb., during 328 days. We burned off 14.4% carbon equivalent.

KILLEN: We have around 5 to 6% coke, normally, when we regenerate.

BANKS: Several companies are now marketing extruded desulfurization catalysts. Have pressure-drop problems been any worse with extruded than with pelleted catalysts?

WRIGHT: We've used both pelleted and extruded catalyst in the pretreater for our reformer. For the same feed rates, on the Oronite $\frac{1}{16}$-in. catalyst, which is pelleted, we had a ΔP of 9 and on the extruded, American Cyanamid HDS-2 $\frac{1}{8}$-in. catalyst we had 12. We don't feel that is particularly significant. Most of our lab data have shown that with pellets of the same size for a vapor feed unit, there is no significant difference in pressure drops.

HARRELL: Several have asked about UOP S6, Hydrobon catalyst. It is a spherical type that we plan to make available at an early date. The spherical type might be even less prone to pressure-drop troubles.

BROOKS, JOHN A. (Standard Oil Co., Ind.): Do you have any trouble handling extruded catalyst? When you dump the screen, is it worse than the pelleted catalyst?

WRIGHT: Our main problem is that 50% of our furnace tubes are not protected by alloy or aluminizing. We have a great deal of iron sulfide carrying into the reactor. To remove our pressure drop, after every regeneration, we go in and top out, down to the bottom of our basket area. We currently have baskets that are 4 ft. deep. On comparing the two catalysts, we feel there are more fines in the extruded catalyst bed. The controlling factor in our pressure drop is iron sulfide scale on the top portion of the bed.

KERSEY: What is the practice when pressure drop has increased through the desulfurizer to the point where you have to do something about it. Is the catalyst normally completely taken out of the reactors or just the top portion skimmed off and screened?

ROSE: On the three of our five trains which have radials you've got to do a complete job. On the other two, when we've built up pressure drop on the top of the bed, we go in and carefully scoop off the top 1 ft. or 1½ ft., and just replace that portion of the catalyst bed, with very good results.

WRIGHT: We have complete pressure-drop removal in our unit by just topping out about 4 ft. of the top of the bed which is the limit of our basket area. We come back to virtually what the original pressure drop was with the new catalyst.

ROSE: I know some of you with piped liquid feed entry systems into down-flow reactors have experienced some pressure drop and plugging in the piped system. I wonder if anyone has changed to a different type of feed inlet system, and what his experience has been.

OLESZKO, T. J. (Aurora Gasoline Co.): Originally we had a pipe distributor which had several hundred 0.5-in. holes to distribute the oil, and the distributor plugged with scale from the furnace. We removed that type of distributor and replaced it with a distributing tray. This tray consists of about 150 chimneys, roughly 3 in. in diameter with bubble caps over the top. One other feature of these chimneys is a slot across the diameter about ⅛ in. wide and 2 in. deep. Thus, if the tray is not exactly level you will still get good distribution. This tray catches quite a bit of scale as it comes from the furnace.

YEATMAN: We use the basket-type. We had one occasion where we knew we were going to be shutting down in a month to open up the system, so we decoked the furnace and then went back on without cleaning the baskets. No appreciable increase in pressure drop over that in a clean system was noted. Since this worked out we have repeated the procedure twice on another charge. However, following the second trial while initial pressure drop was low, the rate of pressure-drop buildup has increased rapidly. Experience shows you can regenerate the catalyst within limits and still not open up the reactor.

HARRELL: Additive has been used to stop rapid pressure-drop increase due to fouling. Reactor pressure-drop increase has been stopped to where a normal run could be finished by using 20 to 30 p.p.m. Polyflo in unit feed. We do not understand why it works, but if your reactor pressure drop starts up rapidly, it is worth a try.

BANKS: Has anyone added sulfide to a dehydrosulfurization cobalt-moly catalyst to improve its nitrogen-removal ability, and if so, what procedure was used?

ALEXANDER: We have never added sulfide to desulfurization cobalt-moly catalyst, but Esso Standard Oil does have a procedure for adding carbon disulfide to a cobalt-moly catalyst. They say it gives very substantial increase in the desulfurization activity. I don't know just what effect it would have on the nitrogen removal, but they do have a procedure for adding sulfur in the form of disulfide to their catalyst prior to startup.

BANKS: Use of hydrodesulfurization to pretreat feed to catalytic cracking units is of current interest to refiners. Do metals in the feed affect the life of the cobalt molybdenum desulfurization catalyst?

WRIGHT: All I have on this is an opinion from our research department. They feel that the saturation level of heavy metals will ultimately determine the life of the catalyst, more so than loss of desulfurization or denitrogenation ability.

VERITY: I think that nickel carried through would increase the life of the catalyst; nickel sulfide is a good catalyst. We were wondering if anyone has had experience with carbon monoxide or carbon dioxide in

the hydrogen-treat gas, and what effect it has on the catalyst activity.

BROOKS: A study was made at Whiting some years ago on this problem. Carbon monoxide in the gas will seriously affect the performance of the catalyst.

Desulfurization processes

BANKS: What various methods are being used to treat odorless naphtha to improve odor?

CHAMBERLAIN: We are currently going through a naphtha caustic wash and following that with hypochlorite and another caustic wash. We think it is odor-free but it still has an odor. In the laboratory we have tried filtering it, and putting it through silica gel, this seems to improve it slightly.

VERITY: Does anybody use hydrogenation for improvement of odor?

CHRISTENA, J. D. (Rock Island Refining Corp.): We started up our plant when we went to Platforming, with a 500-bbl. a day Unifiner. Later on we had to add a 5,000-bbl. per day Unifiner, and the little unit sat idle. We've now put that into Stoddard naphtha service. This treated naphtha has an unusual odor, but after running the dry cleaner's test on it, it has no "residual" odor, so the over-all effect is better. Copper-treated naphtha is sweet as compared to our Unifined material, but Unifined material has less residual odor, so it is working fine.

BANKS: Is anyone removing the hydrogen sulfide from hydrogen recycle gas? If so, what is economic justification?

ROSE: On our Train 5, Unifining light cat gas oil and light coker gas oil, we scrub H_2S using diethanolamine. The economic justification is the cost of hydrogen. I don't have the numbers, but I am sure it could be justified.

ALEXANDER: It would seem to me that one of your biggest economic justifications for removing the hydrogen sulfide from recycle gas would be to reduce corrosion on the high-temperature side of your equipment.

BANKS: Is anyone using the UOP Merox process in treating? If so, what are they treating? Has anyone treated kerosine with Merox?

HARRELL: UOP has a descriptive paper out on Merox (OGJ, Oct. 26, 1959, p. 73) and there are other data sheets out which give pertinent information. It has good application, gives advantages of operation at lower temperatures, without the expense of heating or cooling. The equipment is very simplified and inexpensive. This process has been used commercially for some time.

OLESZKO, T. J. (Aurora Gasoline Co.): Recently we converted from a fixed copper bed to treat visbroken and straight naphtha with Merox. We find it very satisfactory; we're very happy with it. We used old equipment, and have equipment left over.

MADDOX: UOP has just screened a couple of our kerosines for us, and unfortunately we picked the wrong ones to send them. We picked some we couldn't treat ourselves, and this, I'm afraid, is one of the cases where UOP couldn't help us on the Merox process. They don't know why it won't treat, and they're still looking.

HARRELL: The process can be used for mercaptan extraction or sweetening. A combination of the two processes can be used on gasoline and lighter-boiling-range hydrocarbons. Sweetening is used on many kerosines, jet fuels, and light fuel oils.

BANKS: Has anyone tried electrostatic desulfurization and found that it reduced feed effluent exchanger fouling?

ROSE: We have a Petreco scrubber on our heavy cat naphtha to our train 3. Its purpose is to remove thiophenols and help us with feed effluent exchanger fouling. We've had very good experience in this regard. It has been suggested from time to time that we try to run without it, but we haven't had the nerve to do it.

Gas blanketing

BANKS: Is gas blanketing being used? If so, is it successful? What gas is used? Is anyone filtering? What is solid content in p.p.m.? Does anyone check for preformed gum?

HARRELL: In checking many stocks to determine cause for preheat exchanger fouling, there has been no correlation with preformed or potential gum. If anyone else is doing any of that work we would sure like to hear from you on it. At one time we thought Erdco test data would indicate tendency to foul. There seems to be no definite correlation yet on that. Fouling has been more pronounced in the presence of oxygen in certain feed stocks, but there again, the quantitative data are hard to rely on.

BROOKS: One of the first things we did when we got into this fouling problem was to look at the gum problem. We made a practice of monitoring feed stocks for both potential and existing gum. We did find, by tracing the various streams that were feeding naphthas to our reformers, that if we picked up one that had either potential or preformed gum in it, and cleaned it up by going back to the crude unit or checking to see that there wasn't some contamination getting in, we did reduce the fouling problems. We have set criteria on our naphthas and we do not like to see either existent or preformed gum exceed about 1 or 2 mg. If they do, we find these naphthas will contribute to the fouling problem.

HARRELL: Have you found any of the antioxidants or inhibitors that might reduce the tendency of those gum formers to foul?

BROOKS: No. We make a very particular point of keeping oxygen out, and we particularly like to avoid naphthas that might have either preformed or potential gum. When you have cracked stocks going in, of course, you have large amounts of potential gum and the way to handle this is to run directly into the reformer without intermediate tankage. We do not use antioxidants in the naphthas. However, Nalco antifoulant is effective.

CHAMBERLAIN, J. P. (Delta Refining Co.): I've a little different facet on this thing, from a product standpoint on filtering. We had a few complaints on some of our diesel. We installed one of Warner Lewis' 5μ filters and it didn't seem to do too good a job, so we switched to a new 2μ cartridge unit. This showed color improvement. We also had some No. 2 fuel oil that went off color to about a No. 4 color. The 2μ filter wouldn't touch it. We switched from a 2μ Warner-Lewis over to a Commercial Filters Corp. 1μ. This 1μ showed a very, very slight color improvement. Following that, we went to the submicron range by coating the 1μ filter with diatomaceous earth without any additional improvement in color. We finally had to go to an adsorbent, to improve the color.

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BANKS: Does anyone gas blanket floating-roof tanks to keep O_2 out of annular space? If so, how?

KILLEN: We have tried doing this with nitrogen, but never achieved successful blanketing. It took too much gas to do it in our particular tanks, which were not really the most ideal floating-roof type. I recall someone doing this with fuel gas out on the West Coast, and I think they were using about 15 cu. ft. a minute of gas to maintain a pressure of from ½ to 1 in. of water on the annulus, or wherever they could take the pressure on the roof of the tank.

KILLEN: We would prefer normally to have a cone-roof tank and gas blanket. We wouldn't build a floater any more for hydrogenation unit feed.

ZANDONA: We've taken the opposite route, and have used floating-roof tanks for catalytic reforming charge as well as charge to a Udex unit. If oxygen absorption in the feed stock occurred, it would be noted in an increase of catalyst consumption. So far, we have very low glycol consumption in our unit and we find no need to go to the added expense of gas blanketing of our floating-roof intermediate storage tanks.

YEATMAN: There is one other advantage for gas blanketing tanks—reduced maintenance. You will find that corrosion is considerably less.

Filters

BANKS: Who uses filters for finished products? Gasoline and fuel oils to their loading racks? What kind of filters? What is the filtering media?

KERSEY: We had some occasional problems, mostly involving rust, in loading finished products. We installed filters, without too much success. We have found that a periodic cleaning of our tanks has, for all practical purposes, eliminated this problem. We have set up a program of cleaning our jet fuel and distillate tanks about once a year. We have another problem, though, that may be allied to filter use. When we run down to storage in the winter time, with a fairly warm distillate stream, the material sits in the tank and cools. Then we start getting haze formed from water dropping out. This haze has been very difficult to remove. We have tried salt filters; we've tried blowing the tanks with air, and—particularly when the tank contents get down below 40°—we just can't do much with it.

ALEXANDER: We had a very similar problem in our refinery, and we have installed a Bowser filter. It will effectively remove the water haze. You have to use a fine sediment filter ahead of it, because if you get pressure drop over about 5 psi. on the filter, the water-removal efficiency drops way off, and you just can't clear it up. We've got a 5μ sediment filter ahead of this water filter, and the two in conjunction will clean up the water and give us a bright product with a minimum of trouble.

MARDAGA, L. W. (Gulf Oil Corp.): If you have caustic in the water bottoms it hinders coalescing and settling. I'm not sure of the chemistry, but I believe iron hydroxide is formed and this tends to hold moisture and rust in suspension. Your suggestion of cleaning out the tanks, if you have that problem, is very good. If you haven't time for that, flushing out the water bottoms can be very helpful.

HARRELL: Haze may be caused by naphthenic acids that could be removed by correct treating method, particularly on distillate stocks. Naphthenic acids or sodium salts thereof, can add a permanent haze to an oil and it is very simple, in some cases, to scrub those out with a dilute caustic. There are various types of filters used. Actually on these loading filters it may be more economical to go back and try to correct the rust problem or the haze problem than to try to filter the material out.

Rust, for example, can well indicate a need for a corrosion inhibitor. Everyone has considered one time or another the use of corrosion inhibitors on their final blends, and particularly in their pipelining, to keep from picking up rust or to keep from forming rust, but few people go back and actually either correct the problem at the unit itself, or correct it in the rundown tanks, blend tanks, and intermediate tanks, before it goes into the loading lines. The simple thing to do is use inhibitor in the process unit that is still effective in storage.

MARDAGA: While corrosion inhibitors may be very helpful, there are some which will tend to promote emulsification, or hinder coalescing. Use of corrosion inhibitors, at times, can make the problem much more serious.

HARRELL: Corrosion inhibitors in high enough concentrations can trend toward emulsification. You normally regulate your dosage to where you do not get into this realm of operation, and particularly use the dosage that you know will give you good control.

CORNELI: We will be the last ones to say that corrosion inhibitors have not caused emulsion but like everything else, advances have been made in this field, and some of the newer compounds do not tend to cause emulsions like many of the older ones.

Mist extraction

BANKS: What is the commercial experience on mist extractors to improve lube feed stock from a vacuum unit? Where are they located? What life can be expected? How are they cleaned?

VERMILION: At our Lima vacuum unit we installed a demister above the flash zone, and the primary result was a rather dramatic improvement in color.

BRADFORD, W. H. (Standard Oil Co., Ohio): The demister pads are not cleaned; they are replaced. Their life has been about 1 year to 18 months. Recently as a result of a revamp of the vacuum tower, the demister was raised one tray and the demister area reduced 40%. As a result, the life dropped to 6 weeks. They have gone back to the original installation.

ROHLER, C. W. (Cities Service Oil Co.): What is the design philosophy of utilizing mist extractors in vacuum towers when producing cat cracking feed stock? Are they normally including them in these towers?

VERITY: In general, we do favor them. We've had very good results. Of course, they become very expensive in the large vacuum towers, and that is always a consideration, but we have swung over to pads for mist extraction to a considerable extent. Cleaning them is a problem. With luck, they don't have to be cleaned very often.

ROHLER: We clean ours by complete disposal.

deLOOPER: We found they are essential in our vacuum towers. At one time, one of ours came loose, and we had to reduce our vacuum by about

7 in. of mercury to have a clean feed stock. We discard our demisters also.

CHAMBERLAIN, J. P.: We operate two vacuum towers. Both have demisters. One tower has a black-oil draw deck just below the demister. There are sprays on the demister, and heavy and light-gas-oil refluxes. The other tower is completely open, with only a demister on top. Gas oil from the open tower has less carbon than the other. The feed stock to the two towers is the same, since they operate in parallel. The open tower has a tangential inlet, while the other has a center-line inlet which turns down at about 45°, so that liquid will spiral down the tower. Does anyone know how to solve this problem?

MADDOCK: We had a vacuum unit which seemingly gave a good, clean feed stock for cat cracking, at a charge rate of about 14,000 bbl. per day of reduced crude charge. We put in a demister and a tangential inlet, which was a device covering about half the circumference of the vessel, rectangular in shape, with a straight line on top and a descending bottom, so that the opening was about 2 by 4 ft. It improved our ability to give a good, clean feed stock with crude rates up to 50,000 bbl. per day. This was previously just a tangential entry to the tower.

We do not run a wetted demister. We have a scrubbing section of two trays just above that, with a wax distillate draw.

CHAMBERLAIN, J. P.: We operate one wet and one dry, and the one we operate dry doesn't seem to have much more difficulty than the one we run wet.

ADAMS: Two other factors which make a lot of difference in vacuum towers, are the disengaging height above the inlet and the vapor velocity in the flash zone, which might be different between these two units.

CHAMBERLAIN, J. P.: The disengaging height on one is 15 ft. 3 in. and the other 15 ft. 0 in.

VERITY: Couldn't you modify the bad one to be like the other?

CHAMBERLAIN, J. P.: We, like everybody else, want to do it the easy way, with the least down time.

MARDAGA: Has anybody used a mist pad in the top of a vacuum tower to cut down carryover into the surface condensers, or barometric?

ZANDONA: We have installed a mist extractor on the top section of our vacuum tower just below the vapors entering the steam jets, and it also helped very materially. We had a considerable amount of oil carryover before the installation of the mist extractor. We have three-stage jets, one booster and two other stages. This operates satisfactorily.

What is the difference between a good cat cracker feed stock and one that is poor? Is relative Conradson carbon between the two a major factor?

FLOOR COMMENT: We run at Conradson carbon of 0.2 to 0.5 and do very well. But when our York mesh screen went bad, we were up to about 1.2 and we were encountering afterburning problems.

CHAMBERLAIN, J. P.: At the time the tests on our units were made, both vacuum towers were producing penetration asphalt: No. 1 tower, 66 penetration, and No. 2 tower, 63 penetration. The Conradson carbon residue was 0.68% on the first and 0.56% on the second. The No. 1 tower had 200 lb./hour of steam in it, while No. 2 tower had none.

BOOKS

GAS PURIFICATION. By Arthur L. Kohl and Fred C. Riesenfeld. Published by McGraw-Hill Book Co., Inc., 330 West Forty-second Street, New York 36. 556 pp. $15.

This book provides factual descriptions, methods, and other useful working data for the design of gas-purification and dehydration units most commonly used in industry today. Such important areas as corrosion, foaming, and materials of construction are taken up in detail.

Subject matter is limited to the removal of gas-phase impurities which are present in gas streams in relatively small quantities rather than the removal of large solid or liquid particles which would more properly be classified under separation.

Special importance has been given to the ethanolamine processes for removal of hydrogen sulfide and carbon dioxide, including the design and operation of commercial plants. Other subjects covered include hydrogen sulfide and carbon dioxide removal with ammonia and alkaline salt solutions; water absorption of impurities; sulfur dioxide removal; gas dehydration and purification techniques.

1960 REGISTRY OF INDUSTRIAL RADIO SYSTEMS. Published by Communication Engineering Book Co., Monterey, Mass. 229 pp. $5.

Listings in this fifteenth annual edition include mobile and relay systems operated by special industrial, forest products, power utility, petroleum and gas pipe lines, relay press, motion picture, and VHF maritime services.

Part 1 lists the systems by names and addresses of the licensees, showing the location of the control points, frequencies, call letters, number of mobile units authorized, and make of equipment used. Part 2 lists the stations by operating frequencies, an extremely valuable feature because it shows the number and locations of systems assigned to each channel.

The 1960 edition has been completely revised from FCC records at Washington, to show the latest changes, additions, and deletions made during the past year.

PETROLEUM ENGINEERING—DRILLING AND WELL COMPLETIONS. By Carl Gatlin. Published by Prentice-Hall, Inc., Englewood Cliffs, N. J. $13.00. 341 pp.

A complete, workable text covering all phases of oil-well drilling and well completion. No prior knowledge is assumed, and the early chapters are devoted to coverage of such topics as the nature of petroleum, rock properties, exploration and leasing methods. One chapter is devoted to cable-tool drilling, and the remainder to rotary drilling primarily, with complete discussions on coring, logging by all popular methods, drill-stem testing, formation damage and well completion, including cementing.

The organization of the book, and the inclusion of material from all levels of understanding make this an excellent text for the student as well as a valuable reference work for the advanced engineer.

Liberal use is made of examples in the text, and numerous problems are included, with answers, for class assignments or for self-study purposes.

Additional features include the discussions of several drilling methods still in the experimental stage. This is one of the first writings to incorporate these developments under one cover.

Engineers working with problems involving gas calculations will appreciate the simplified compressibility charts that can be used without first determining the reduced properties.

UCLA LAW REVIEW, OIL AND GAS ISSUE. Published by School of Law, University of California, Los Angeles 24. 410 pp. $5 per year; $1.50 per issue.

This number features three articles which were originally presented at a symposium conducted by the California Committee on Continuing Education of the Bar. These articles have been augmented and footnoted by their authors. Also included are extensive student materials exploring recent developments in the oil and gas area.

Paul E. Bermingham, associate general counsel for Mobil Oil Co., has contributed an article entitled "Legal Aspects of Petroleum Marketing Under Federal and California Laws," in which each phase of petroleum marketing is investigated in light of possible attack under the antitrust laws. The scope of this work makes it a necessity not only for those concerned with the petroleum industry but for anyone who represents any business which is engaged in marketing a product in interstate commerce.

"The Rule Against Perpetuities as It Affects California Oil and Gas Interests" is the subject of an article presented by Bruce M. Jones, associate counsel and secretary of Security Title Insurance Co. Jones, after a brief discussion of the development of the rule, thoroughly analyzes its application to interests in oil and gas in light of several recent and very important California decisions.

The increasingly important topic "Community Leases and Pooling Clauses," is the basis of an article contributed by Douglas C. Gregg, assistant general counsel for Union Oil Co. The many factors which compel the voluntary combination of separately owned tracts in order for the most economic exploitation of these tracts make a study of this subject particularly appropriate at this time.

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Lab studies shed light on compressor-cylinder cooling

• Test results reveal qualitatively the thermodynamic trends to be expected from a normal compressor-application situation. Use of this information should aid in the rational evaluation and selection of cylinder-cooling systems.

BY W. F. HARTWICK
Manager Gas Compression Engineering
Cooper-Bessemer Corp.

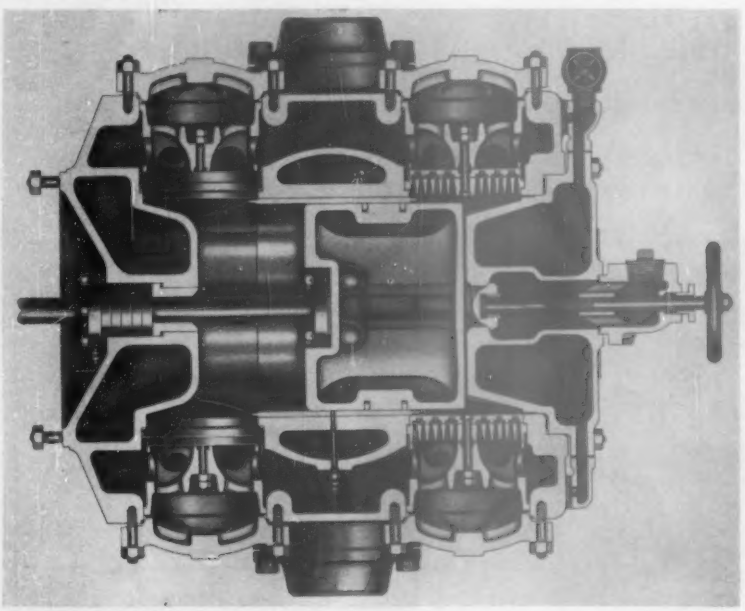
EXCEPT for designs intended exclusively for low-compression-ratio applications, heavy-duty reciprocating compressor cylinders are normally provided with coolant jackets. Jacketing of a typical double-acting cylinder is indicated in Fig. 1.

Jacketed cylinders afford the following alternatives with respect to degree of cooling provided.

1. No coolant. (Nonjacketed cylinders also fall in this category.)
2. Thermally circulated coolant. (This scheme consists merely of filling cylinder jackets with a suitable liquid. Differences in temperature between suction and discharge portions of the cylinder result in natural circulation of the coolant.)
3. Mechanically circulated coolant.

These possibilities are, of course, listed in order of economy with respect to first and operating cost of the cylinder cooling system. In selecting the degree of cooling to apply to reciprocating compressors it is desirable to choose the minimum arrangement which will insure satisfactory mechanical and thermodynamic performance of cylinders.

In general, knowledge as to the effects of degree of cooling on mechanical performance is gained through extended field operation while the influence on thermodynamic performance is best determined in the laboratory. This article will deal principally with the latter phase, but will include general recommendations for application limits established principally on the basis of mechanical considerations.



JACKETING of a typical double-acting cylinder is shown in cross-section. Fig. 1.

Laboratory Program

Following are the general objectives of the two distinct laboratory projects undertaken:

Project 1—Investigate the influence of degree of cylinder cooling on capacity, horsepower per unit capacity, and gas temperature rise.

Project 2—Determine heat rejection and associated effects for operation with mechanically circulated coolant.

Laboratory Equipment and Methods

Laboratory investigations to be reported were made in Cooper-Bessemer's newly completed compressor research laboratory. All work was done while compressing air with staged cylinders of 26½ and 15¾-in. diameters connected to an engine-driven compressor frame of 10½-in. stroke.

Data pertinent to results were obtained as follows:

Air flow—ASME exit nozzle.

Air temperature — calibrated thermocouples.

Air pressure—barometer, water manometer, calibrated pressure gages, and indicator pressure-time records.

Jacket-water temperature—mercury-filled glass thermometers.

Jacket-water flow—flow diverted to container of known volume and fill time obtained with stop watch.

Indicated horsepower (i.h.p.)—from pressure-volume replots of high-speed indicator pressure-time records.

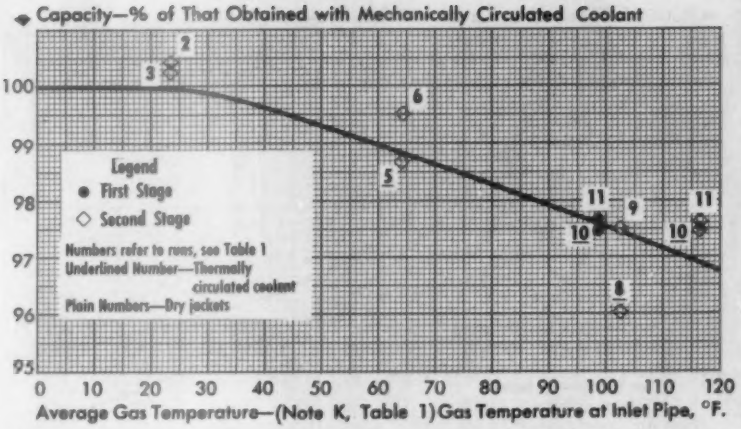
Since it was expected that some effects to be investigated would be small, extreme care was taken in obtaining and processing data.

Water was used for all runs requiring coolant.

Project 1

This series consisted of runs at three compression ratios with each of the three basic jacket situations, i.e., mechanically circulated water, thermally circulated water, and dry jackets. Work was confined to the second-stage cylinder since terminal pressures and inlet air temperature could all be controlled. Significant data and results are included in Table 1.

Referring to item O, Table 1, as compression ratio increased, capacity with thermally circulated water and



CAPACITY OF CYLINDERS with thermally circulated coolant and dry jackets relative to that obtained with mechanically circulated coolant. Fig. 2.

dry jackets relative to that obtained with mechanically circulated water decreased. A study of items G, H, and O indicated that capacity reductions were associated quantitatively with air preheating encountered in compressor inlet passages.

It was reasoned that preheating for the cases of thermally circulated coolant and dry jackets would be a function of the difference between average air cycle temperature and air inlet temperature, so relative capacity was plotted against this function.

Although considerable point scatter exists, the following comments seem appropriate:

1. The trend is definite.

2. Distribution of points does not justify distinguishing between capacity with thermal circulated coolant and dry jackets.

3. For the higher abscissa values, which in general represent the higher compression ratios, capacity effect is appreciable and should be considered when compressor cylinders are sized.

Horsepower per unit capacity. Because of heat removed by the coolant, cylinder horsepower was expected to be noticeably less during operation with mechanically circulated water than for the other two jacket conditions. Actually the reverse was found.

A careful investigation of this situation by superimposing cylinder pressure-volume diagrams for runs of a given compression ratio revealed causes of variations encountered. Horsepower for run 1 was considerably higher than for runs 2 and 3 because a slightly higher discharge pressure existed. This increased the actual compression ratio somewhat above that indicated by gage readings. The lower capacity for run 1 is also explained by the larger ratio.

The other, less-severe horsepower variations found were attributable to slight dissimilarities in the configuration of pressure waves existing at cylinder flanges. These variations in wave shape did not significantly alter cylinder pressure at the start of compression or reexpansion and so did not influence capacity. Surprisingly, it was found that compression lines for the three jacket situations followed practically identical paths. Expansion lines also coincided almost perfectly.

From the foregoing it was concluded that, within the limitations of this investigation, degree of cooling had no fundamental effect on the horsepower requirement of a given cylinder and, consequently, that the influence of horsepower per unit capacity is inversely proportional to capacity effects shown in Fig. 2. Since compression and expansion paths were not noticeably altered by operation with mechanically circulated coolant, it appears that heat removal during these portions of the cycle was negligible.

Evidently heat removal in compressors with mechanically circulated coolant is accomplished largely during the discharge portion of the cycle and in the discharge gas passages. This is entirely logical since the largest difference between gas and coolant temperatures prevails here.

Air-temperature rise. Item M, Table 1, shows ratio of observed to adiabatic gas-temperature rise for the three basic jacket situations. Results for the cases of thermally circulated coolant and no coolant, again plotted against average gas temperature minus inlet gas temperature, are given in Fig. 3. A similar plot for mechanically circulated coolant is included in the discussion of Project 2.

Fig. 3 shows dry jacket operation produced temperature rises consistently higher than those experienced with thermally circulated coolant indicating the superior heat-transfer characteristics of the latter arrangement. This was also reflected in cylinder heat-balance calculations wherein an average of 9% of the energy input was unaccounted for with ther-

TABLE 1—INFLUENCE OF DEGREE OF COOLING ON PERFORMANCE DATA AND RESULTS

A.	Run number	1	2	3	4	5	6	7	8	9
B.	Compression ratio, Rc	1.33	1.33	1.33	2.08	2.08	2.08	2.98	2.98	2.98
C.	Suction pressure, psia.	33.2	33.2	33.2	36.1	36.1	36.1	39.8	39.7	39.7
D.	Jacket condition	MC	TC	D	MC	TC	D	MC	TC	D
E.	Average jacket-water temp., °F.	95.6	126	.....	95.6	171	.....	95.4	208	.....
F.	Jacket-water temp. differential, °F.	10.0	.....	.....	10.2	.....	.....	10.5	.....	.....
G.	Observed air temp. at inlet pipe, °F.	99.5	99.5	99.5	100.5	100.5	100.0	99.5	100	100.5
H.	Observed air temp. at inlet valve, °F.	99.0	101.5	100.5	100.5	107.0	106.0	100.0	115.0	115.5
I.	Observed air temp. at discharge pipe, °F.	160.5	164.0	166.0	229.0	251.4	254.5	286.5	325.0	337.0
J.	Adiabatic air discharge temp., °F.	147	147	147	232	232	232	304	304	304
K.	Calculated avg. air cycle temp., °F.	123	123	123	166	166	165	202	203	203
L.	Avg. air temp.—air temp. at inlet pipe, °F.	23.8	23.8	23.8	65	65	65	102	103	103
M.	Observed air temp. rise/calculated air temp. rise	1.284	1.358	1.400	.977	1.157	1.188	.914	1.103	1.156
N.	Cylinder brake horsepower	59.1	56.6	55.7	123.5	124.3	124.7	184.3	182.6	177.1
O.	Relative air capacity, % of that mech. cir. coolant	100	100.4	100.2	100	98.7	99.5	100	96	97.5

D = MC designates mechanically circulated jacket water; TC, thermally circulated jacket water; D, dry jackets.

J = $T_{(discharge)} = T_{(inlet\ pipe)} R_c^{0.4/1.4}$ where R_c is compression ratio.

K = $T_{(avg.\ cycle)} = [T_{(calc.\ disch.)} + T_{(inlet\ pipe)}]/2$.

M = Temperature rise determinations based temperature of air at inlet pipe.

N = Brake horsepower = indicated horsepower/0.95.

mally circulated coolant and only 4.8% unaccounted for with no coolant. Unaccounted-for heat, of course, represents principally conduction and radiation losses.

The fact that observed temperature rise exceeded the adiabatic over the entire range of Fig. 3 indicates the need for recognizing this effect in engineering inter and aftercoolers.

Project 2

This series of tests was designed to investigate those variables thought to be most important in heat rejection and associated effects for operation with mechanically circulated coolant. Data were obtained on both cylinders of the laboratory unit during two-stage operation. Findings are summarized in Table 2.

Heat rejection. In keeping with fundamentals of heat transfer, the independent variable for expressing heat rejection should in some way involve the temperature difference between the two media, gas and coolant. Moreover, since the information was being obtained to serve as a guide for the future application of cooling, it was necessary that the temperature difference used be general in nature, relatively easy to determine, and not require operating data. After considerable study, the independent variable used by May and Clark[1], i.e., average gas cycle temperature minus average coolant temperature, was adopted.

Best correlation of data for the test cylinders was obtained by plotting absolute heat rejection, i.e. B.t.u. per hour, against the chosen abscissa. See Fig. 4. The fact that results from both cylinders conform well to the same straight-line interpretation indicates the two designs have similar heat-exchanger characteristics.

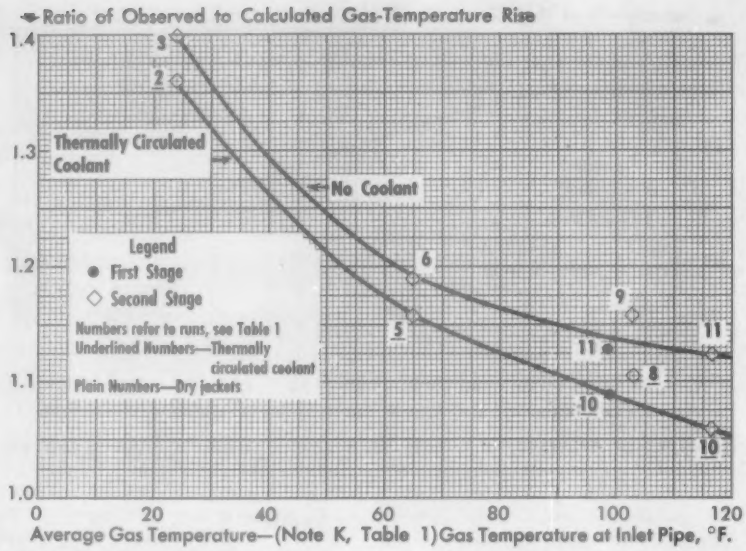
Although the representation in Fig. 4 was revealing, it did not provide the degree of generalization desired. Specific-heat rejection, i.e., B.t.u. per brake horsepower hour, was finally selected as the best dependent variable since it provided reasonable correlation of results and simple generalization. See Fig. 5.

The influence of coolant and operating variables on specific-heat rejection will now be considered.

1. Jacket-water temperature—Runs 12, 13, and 14 were conducted at practically constant conditions of air pressures, air inlet temperatures, and jacket-water temperature rise (10° F.). The important variable was average jacket-water temperature. With the exception of run 12, second stage, which is about 50 B.t.u./b. hp.-hr. low, all values agree well with the suggested representation of results. The effect of jacket-water temperature on other performance variables will be considered later.

2. Jacket-water temperature differential—Runs 15 and 16 were duplicates of 12 and 13 except jacket-water differential temperature was increased to about 15° F. The definite trend to lower heat rejection is probably due to poorer heat transfer associated with reduced water velocities prevailing for these runs.

Attempts to establish 5° F. water-temperature differential were unsuccessful; but run 18, made with 93° F. average water temperature and 7.5° F. rise, gave specific rejections agreeing closely with the suggested curve indicating results to be essentially the



GAS-TEMPERATURE-RISE characteristics for operation with thermally circulated coolant and dry jackets. Fig. 3.

Table 2—Heat rejected to mechanically circulated

First Stage

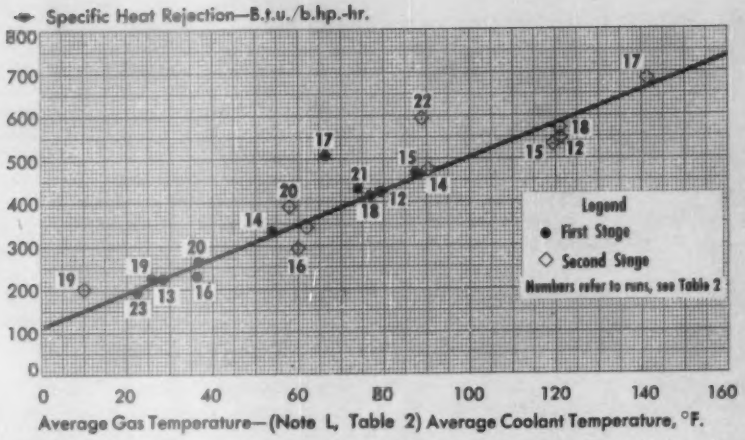
A.	Run number	10	11	12	13
B.	Compression ratio, R_c	2.97	2.99	2.99	2.97
C.	Suction pressure, psia.	14.30	14.23	14.26	14.21
D.	Average jacket-water temp., °F.	TC	D	95.5	156.0
E.	Jacket-water temp. differential, °F.	TC	D	10.2	11.2
F.	Heat rejected to jacket water, B.t.u./hr. X1D^{-6}	TC	D	76.2	39.9
G.	Cylinder brake horsepower	187	190	179	180
H.	Specific heat rejection, B.t.u./b.hp.-hr.	TC	D	426	222
I.	Observed air temp. at inlet pipe, °F.	80	81	76	85
J.	Observed air temp. at discharge pipe, °F.	294	304	266	291
K.	Adiabatic air discharge temp., °F.	277	279	273	283
L.	Calculated average air cycle temp., °F.	178.5	180.0	174.5	184.0
M.	Average air temp.—mean jacket-water temp., °F.	TC	D	79.0	28.0
N.	Observed air temp. rise/calculated air temp. rise	1.086	1.126	0.964	1.040
O.	Relative air capacity, % of that for run 12	97.5	97.6	100.0	98.8
P.	Average air temp.—air temp. at inlet pipe, °F.	98.5	99.0	.....	.....

Second Stage

A.	Run number	10	11	12	13
B.	Compression ratio, R_c	3.39	3.39	3.41	3.42
C.	Suction pressure, psia.	41.1	41.0	40.9	40.7
D.	Average jacket-water temp., °F.	TC	D	95.6	155.8
E.	Jacket-water temp. differential, °F.	TC	D	9.9	10.7
F.	Heat rejected to jacket water, B.t.u./hr. X1D^{-6}	TC	D	114.7	73.6
G.	Cylinder brake horsepower	215	221	211	211
H.	Specific heat rejection, B.t.u./b.hp.-hr.	TC	D	544	349
I.	Observed air temp. at inlet pipe, °F.	101	100	99	99
J.	Observed air temp. at discharge pipe, °F.	349	363	305	332
K.	Adiabatic air discharge temp., °F.	335	334	334	335
L.	Calculated average air cycle temp., °F.	218.0	217.0	216.5	217.0
M.	Average air temp.—mean jacket-water temp., °F.	TC	D	120.9	61.2
N.	Observed air temp. rise/calculated air temp. rise	1.059	1.123	0.876	0.987
O.	Relative air capacity, % of that for run 12	97.5	97.6	100.0	98.8
P.	Average air temp.—air temp. at inlet pipe, °F.	117.0	117.0	.....	.....

G. Brake horsepower = indicated horsepower/0.95.

K. $T_{(discharge)} = T_{(inlet\ pipe)} R_c^{0.4/2.4}$ where R_c is compression ratio.



HEAT REJECTED to mechanically circulated coolant (absolute basis). Fig. 4.

same as for 10° F. rise.

3. Compression ratio—Runs 14, 19, 21, 23 represent runs for which first-stage compression ratio was the only important variable. These results showed good agreement with the proposed curve for ratios from 2.22 to 3.70.

For runs 14, 19, and 20, second-stage ratio was the variable with operating conditions remaining essentially constant. Although run 19 is about 25% above the curve value, this is not of great concern as mechanically circulated cooling is seldom applied to compression ratios as low as 1.50.

4. Horsepower—The effect of horsepower on specific-heat rejection is illustrated by second-stage results for runs 14 and 22. Run 22 was conducted to produce approximately the same compression ratio as run 2 but at a lower pressure level with consequent reduction in air flow and horsepower. It produced a specific rejection 25% above that for run 14 which lies on the curve. This indicates even more discrepancy would have been encountered at a still lower pressure level and reveals a weakness of the specific-rejection approach.

A similar influence was encountered in run 17 where the first-stage cylinder was operated with an unloader pocket open. Although absolute heat rejection for the first stage shows good agreement with the curve, specific rejection is 33% above the curve. Since staged compressors are normally intended to operate fully loaded and provided with cooling for full load horsepower, no cooling problems would be expected for part load operation.

Air-temperature rise. As would be expected, a definite correlation was found to exist between air-temperature rise and heat rejected to mechanically circulated coolant. In the interest of generalization this relationship was shown by plotting the ratio of observed to adiabatic-temperature rise against the same abscissa used to show absolute and specific-heat rejection, i.e., average gas temperature minus average coolant temperature. See Fig. 6.

This relationship allows reasonably accurate prediction of actual discharge temperatures and permits a more realistic determination of inter and aftercooler heat loads than would otherwise be possible.

During the study of air-temperature rise, an energy balance of each cylinder was made for every run. The average unaccounted for heat was 6%. (Unaccounted-for heat was 4.8% for operation without coolant and 9% with thermally circulated coolant.)

Consider next influence of coolant temperature on capacity and capacity per unit horsepower. Runs 13, 14, and 15 were conducted with coolant inlet temperatures of 90, 150, and 120° F. Since this work was done during two-stage operation, the relative influence on first and second stages had to be evaluated. Results, properly adjusted and plotted against the difference between coolant inlet temperature and inlet gas temperature, are shown in Fig. 7. On the basis of these findings, it would appear that no capacity correction is necessary for usual coolant and inlet gas temperatures.

Since horsepower of the test cylinders was not affected by changes in jacket-water temperature, the effect on horsepower per unit capacity is the inverse of capacity effects indicated in Fig. 7.

Application Limits

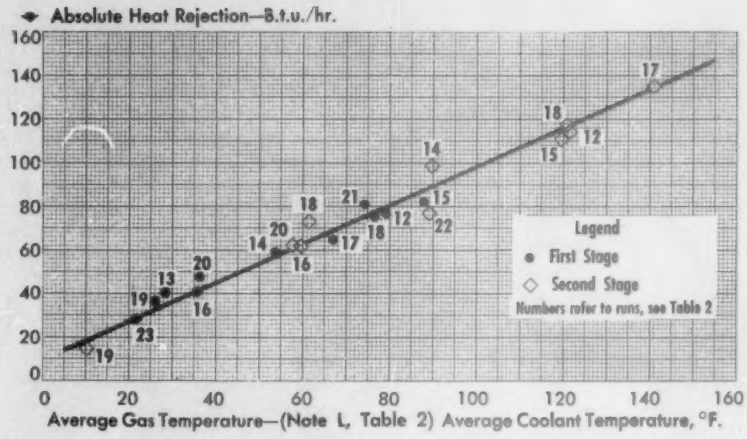
Although information presented permits appraisal of thermodynamic effects associated with various degrees of compressor-cylinder cooling, it does not define application limits. Application limits are dictated largely

coolant; associated effects data and results

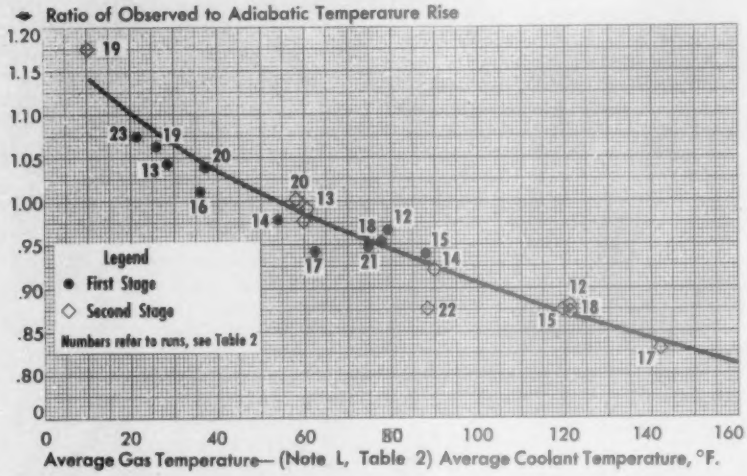
14	15	16	17	18	19	20	21	23
3.06	2.96	2.96	2.66	3.02	2.56	2.81	3.70	2.22
14.30	14.32	14.32	14.26	14.25	14.30	14.29	14.27	14.30
125.3	96.9	157.5	95.3	92.8	125.6	124.6	125.4	125.5
10.6	14.0	16.2	10.3	7.5	10.3	10.2	10.6	10.6
59.7	83.1	41.2	65.8	76.7	36.8	48.0	81.8	29.2
180	179	179	131	184	166	180	194	151
332	464	230	503	417	221	267	423	193
78	86	93	76	71	70	71	78	78
275	272	296	238	259	243	259	309	226
280	284	294	248	268	233	252	322	216
179.0	185.0	193.5	162.0	169.5	151.5	161.5	200.0	147.0
53.7	88.1	36.0	66.7	76.7	25.9	36.9	74.6	21.5
0.975	0.939	1.009	0.941	0.954	1.061	1.038	0.946	1.072
99.2	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....

14	15	16	17	18	19	20		22
3.39	3.42	3.45	4.10	3.38	1.50	2.50	.....	3.32
41.1	40.7	40.4	36.5	41.3	34.3	38.1	.....	26.3
125.5	97.3	157.4	95.0	93.3	124.4	125.0	.....	125.2
10.0	14.7	14.5	10.1	7.6	9.2	10.0	.....	10.2
100.0	113.0	62.9	136.2	117.7	15.2	62.2	.....	78.1
211	211	211	199	207	76	161	.....	132
474	536	298	686	567	200	387	.....	592
99	99	99	98	99	100	100	.....	100
314	305	331	327	301	181	266	.....	301
332	335	336	375	330	169	266	.....	329
215.5	217.0	217.5	236.5	214.5	134.5	183.0	.....	214.5
90.0	119.7	60.0	141.5	121.2	10.0	58.0	.....	89.3
0.922	0.872	0.978	0.826	0.874	1.173	1.000	.....	0.877
99.2	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....

L. $T_{(avg.\ cycle)} = [T_{(calc.\ disch.)} + T_{(inlet\ stge)}]/2$.
TC designates thermally circulated jacket water; D designates dry jackets.


Absolute Heat Rejection—B.t.u./hr.
Legend
First Stage
Second Stage
Numbers refer to runs, see Table 2
Average Gas Temperature—(Note L, Table 2) Average Coolant Temperature, °F.

HEAT REJECTED to mechanically circulated coolant (specific basis). Fig. 5.


Ratio of Observed to Adiabatic Temperature Rise
Legend
First Stage
Second Stage
Numbers refer to runs, see Table 2
Average Gas Temperature—(Note L, Table 2) Average Coolant Temperature, °F.

GAS-TEMPERATURE-RISE characteristics for operation with mechanically circulated coolant. Fig. 6.

by mechanical considerations and are established mainly on the basis of prolonged operation. Limits to be presented here are those established by the writer's company. They are not to be considered inflexible rules but rather as general guides.

1. No coolant. Apply where adiabatic gas discharge temperature is less than 140° F. and differential between inlet and adiabatic discharge gas temperature is less than 80° F. These restrictions are imposed to limit cylinder thermal strains. Widespread use of this jacket situation in natural-gas transmission service has shown it to be successful for such low-compression-ratio applications. The foregoing rule limits the abscissa value in Fig. 2 to 40° F., thereby automatically limiting capacity reduction to less than 0.5% under that obtained with mechanically circulated coolant.

2. Thermally circulated coolant. Filling jackets with a suitable liquid eases the thermal strain situation present with dry jackets and, as was mentioned earlier, provides some small heat-dissipation benefits. These features permit relaxation of limits. Thermally circulated coolant is recommended for cases exceeding the limitations of A but where adiabatic gas discharge temperature is less than 250° F. and adiabatic gas-temperature rise is less than 170° F. This limits the abscissa of Fig. 2 to 85° F. where capacity is about 98% of that for mechanically circulated coolant.

3. Mechanically circulated coolant. Use where the limitations of B are exceeded. Recommended coolant conditions follow:

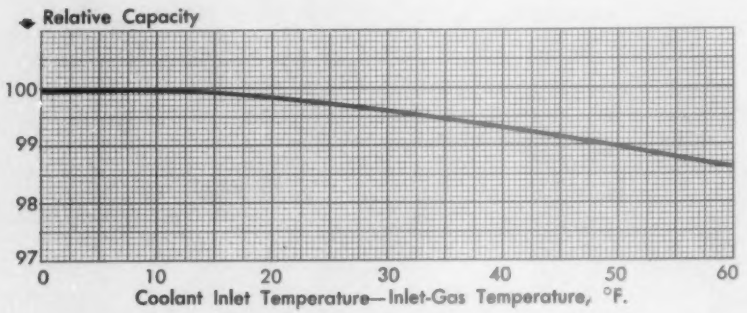
(a) Use minimum coolant supply temperature of 90° F. This limitation is imposed to assure adequate spread of lubrication and avoid piston seizure due to unusually cold coolant.

(b) Maintain a coolant temperature differential of 10° F.

(c) In order to prevent condensation of constituents on cylinder walls, coolant supply temperature should be at least 10° F. above the dew point of inlet gas. If the dew point is not known, maintain coolant supply at least 10° F. above inlet-gas temperature.

(d) To limit capacity reduction (see Fig. 7), coolant supply temperature should exceed inlet-gas temperature by no more than 30° F. except when inlet-gas temperature is below 60° F. The exception was included to make it compatible with (a).

There is, of course, no objection to providing mechanically circulated coolant for applications defined by 1 or 2, above, or to applying thermally circulated coolant to conditions defined by 1.



INFLUENCE of coolant temperature on capacity. Fig. 7.

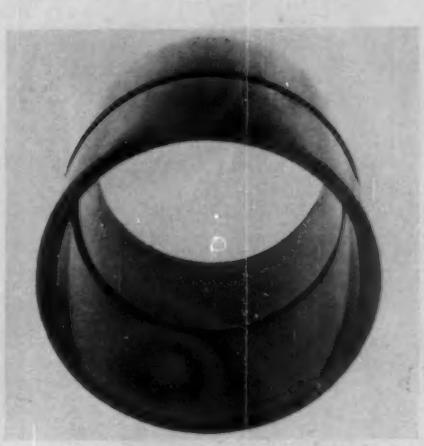
Conclusions

It is certain that cooling-system data obtained from one or two cylinder designs handling a particular gas cannot be generalized to predict accurately the characteristics of all designs compressing any gas. However, the information presented here reveals, qualitatively, the thermodynamic trends to be expected from any compressor application situation normally encountered. Its use aids in the rational evaluation and selection of cylinder cooling systems.

Reference

1. "An appraisal Of Compressor-Cylinder Cooling Requirements" by W. F. May and A. G. Clark, ASME Paper 57-OGP-1.

This two-man welding operation makes . . .



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The pipe has demonstrated value in crude oil, gas gathering, gas distribution, water supply, salt-water disposal, electrical conduit, process lines, sewers, and vent service.

To our knowledge the first high-density polyethylene pipe was made in late 1954. Early in 1955 the first oil-field installations were made in gas, salt water, and crude-oil services.

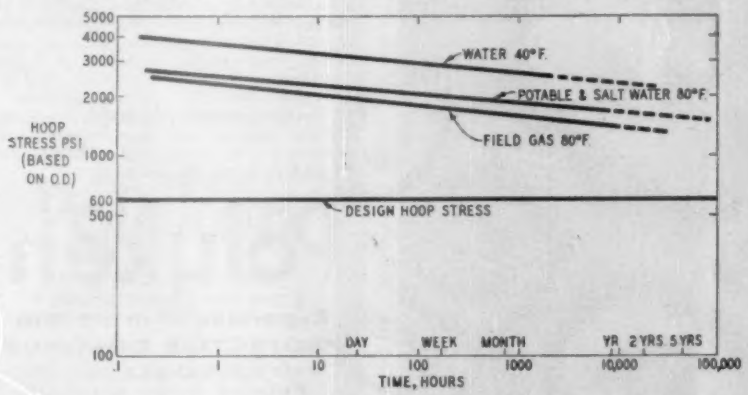
Adapted from "High-Density Polyethylene Pipe in the Petroleum Industry," presented at API Division of production meeting, Southwestern District, Dallas, March 2-4.

BY LEO B. CROLEY
Commercial Development Department, Phillips Petroleum Co.

To take advantage of the available cost savings in these competitive times, in 1959 it became a general policy within Phillips to use the pipe without exceptions in all operations where applicable. Over 80 miles was used by Phillips last year, most of it in the oil and gas fields.

More of this pipe has been used for low-pressure gas gathering than for all other petroleum uses combined. After the test period, the pipe was installed on a commercial basis starting in 1958. Since then over 300,000 ft. in sizes 2 through 8-in. has been installed in this service.

There are several different polyethylenes, and different varieties of high-density polyethylenes. Data, information, and physical properties presented here refer to pipe from Marlex TR-212 resin, which is high-density polyethylene and other polyolefin plastics tailored specially for pipe manufacture. The resin is produced by Phillips Chemical Co., a wholly owned subsidiary of Phillips Petroleum Co.



STRESS rupture-life data for high density polyethylene pipe refer to Marlex TR-212.

Joining Methods

For joining high-density polyethylene pipe, a unique method has been developed known as butt fusion. Butt fusion is fast, low cost, requires no skilled labor, and produces a joint that is stronger than the pipe. No couplings are required.

Here is the step-by-step procedure for making a fusion joint:

1. The ends of the pipe are wiped clean.

2. They are cut square and lined up to avoid a high-low joint.

3. Pipe ends are simultaneously pressed gently against a heated (380-

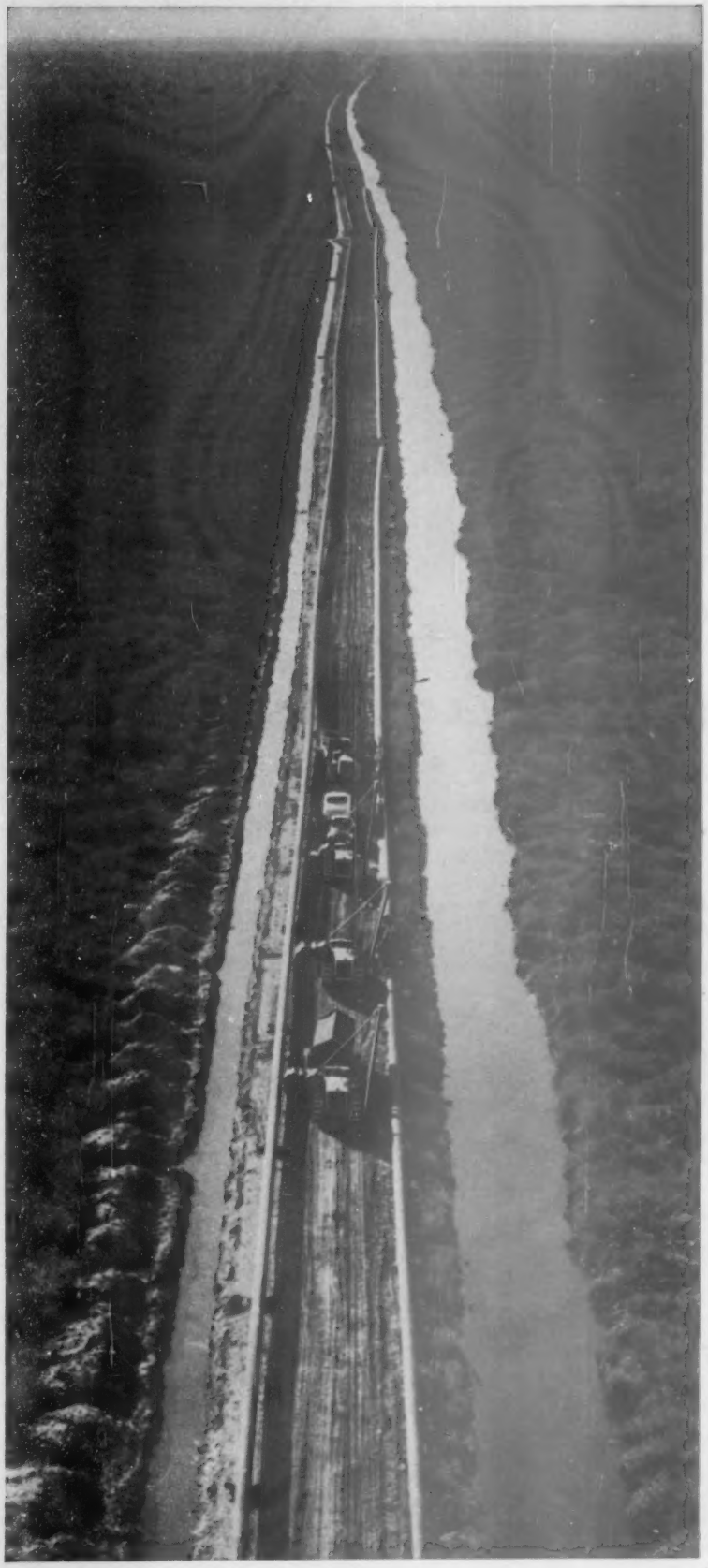


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TABLE 1—PHYSICAL PROPERTIES OF HIGH DENSITY POLYETHYLENE PIPE MATERIAL*

ASTM test		Units	Value
	Characteristic Properties		
D1238-57T	Melt index		0.3
D1505-57T	Density (normal condition)	Gm./cc.	0.960
D635-56T	Flammability	In./minute	1.04
	Thermal Properties		
D1525-58T	Softening temperature	°F.	255
D648-56T	Heat-distortion temperature	°F. at 66 psi.	160
D746-55T	Brittleness temperature	°F.	−180
D696-44	Coefficient of linear thermal expansion	In./in./°C.	1.3×10^{-4}
	Specific heat	Cal./gm./°C.	0.45
C177-45	Thermal conductivity	B.t.u.-in./ft.²/hr./°F.	3.7
	Tensile Properties		
D412-51T	Ultimate strength	20 in./minute; psi.	3,800
D412-51T	Stress at 1% offset	20 in./minute; psi.	3,600
D412-51T	Stress at yield	20 in./minute; psi.	3,800
D412-51T	Stress at rupture	20 in./minute; psi.	2,100
D412-51T	Strain at yield	20 in./minute; psi.	10
D412-51T	Strain at rupture	20 in./minute; psi.	70
D638-56T	Modulus of elasticity	Psi.	110,000
	Shear strength	Psi.	1,800
	Compressive Properties		
D695-54	Stress at 1% offset	Psi.	3,200
D695-54	Modulus of elasticity	Psi.	80,000
	Flexural Properties		
D790-49T	Stress at 1% offset	Psi.	800
D747-50	Stiffness in flexure	Psi.	115,000
D790-49T	Modulus in flexure	Psi.	165,000
	Electrical Properties		
D149-55T	Dielectric strength	v./mil.	475
D150-54T	Dielectric constant	1 kc.	2.64
		1 mc.	2.64
D150-54T	Dissipation factor	1 kc.	0.002
		1 mc.	0.003
	Other Properties		
D256-56	Impact strength IZOD notched	Ft. lb./in.	4
	Hardness shore D		67
	Environmental stress cracking, Bell lab test F_m hours	Hours	300-400
	Transition temp. for recrystallization	°F.	Approx. 140
	Orientation recovery range (macroscopic effects)	°F.	210-260
	Decomposition temp.	°F.	Approx. 600

*Refers to MARLEX TR-212 resin.

TABLE 2 — HIGH-DENSITY POLYETHYLENE PLASTIC PIPE SIZES

Size IPS, in. o.d.:	Working pressure, psi. at 73.4° F.	Wall thickness (in.)	Approximate weight, lb. per ft.
½	155	0.109	0.11
¾	129	0.113	0.13
1	121	0.133	0.21
1¼	101	0.140	0.28
1½	91	0.145	0.34
2	79	0.154	0.46
3	74	0.216	0.94
4	63	0.237	1.33
6	50	0.280	2.30
8	44	0.322	3.50
10	40	0.365	5.00

TABLE 3
Allowable Pressures at Temperatures Other Than 73.4° F. for High Density Polyethylene Pipe

Average operating temp., °F.	Per cent of allowable oper. press. at 73.4° F.
120	30
110	50
100	70
90	85
80	90
73.4	100
60	150
40	200
20	200
0	200

410° F.) aluminum plate placed between them, until a small bead about 1/16-in. in diameter forms and begins to roll back away from the plate.

4. Pipe ends are pulled straight back from the plate, the plate is removed, and the ends are pressed gently together.

5. After the joint is cool (in about 30 seconds on 4 to 6-in.), it is ready for service.

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TABLE 4—COST COMPARISON OF INSTALLED 3-IN STEEL PIPE VERSUS HIGH-DENSITY POLYETHYLENE SCHEDULE 40

	Pipe cost	Lay (incl. weld)	Lay (except weld)	Weld	Coat 10%	Cathodic protection	Total* /ft.
Steel 0.125-in. wall	0.54	0.25	....	....	0.05	0.05	0.89
Steel 0.134-in. wall	0.59	0.25	....	....	0.05	0.05	0.94
Steel 0.141-in. wall	0.65	0.25	....	....	0.05	0.05	1.00
Steel 0.156-in. wall	0.66	0.25	....	....	0.05	0.05	1.01
Steel schedule 40	0.76	0.25	....	....	0.05	0.05	1.11
High-density polyethylene sch. 40	0.69	....	0.13	0.02	....	....	0.84

*Does not include engineering overhead (i.e., right-of-way, survey, etc.).

there will be a reinforcing bead both on the inside and outside of the pipe of about 1/16 to 3/32-in. diameter. Over 10,000 of these fusion joints are giving good service. (Equipment can be bought or rented from P & S Engineering Co., Bartlesville, Okla.)

It takes about 2 to 2½ minutes to make a joint in 4-in. or 6-in. Schedule 40 pipe. Assuming reasonable terrain, two men can easily lay, in an 8-hour day, more than a mile of 6-in. supplied in 40-ft. lengths. The plastic can readily be joined to steel and other common types of piping material by using commercially available fittings.

Field-Installation Techniques

High-density polyethylene pipe is simple, fast, and economical to install. It is installed much in the same manner as steel, with these major exceptions: Few men are required; far less costly equipment is involved (no side-boom tractors).

The light weight of the pipe makes it easy to handle. For example, 6-in. pipe can be loaded on trucks by hand, eliminating the need for hoisting equipment. To avoid cuts or gouges in the pipe, nails or other sharp metal objects on the truck beds should be removed.

Ditch curvature and grade changes for overbends and sags are acceptable up to a radius of 25 times the outside diameter. Stringing up through 4-in. can be done by a truck driver and one man. Above 4-in., two men can work faster. Field joining is done along the side of the ditch with semiautomatic machines for making the fusion joint. Slough crossings are made in much the same manner as going under existing lines. Pipe is joined on firm ground and pushed or pulled through the swampy area. Lengths of over 1,000 ft. have been handled in this way.

After the line has been joined, it is cleaned with soft pigs. It can be shoved into the ditch with little care. Slack in the ditch is desirable for expansion and contraction.

Side bends, overbends, and sags can be more readily accomplished with this plastic pipe than steel because it is more flexible. The pipe should be laid in the ditch to the outside of all curves. Where the pipe crosses under roadways that are heavily traveled or traveled by heavy equipment, it should be cased.

Pressure testing (usually to twice expected working pressure) may be done either with water or air. If air is used, it is good practice to check each joint by using some kind of solution that produces foam such as soap.

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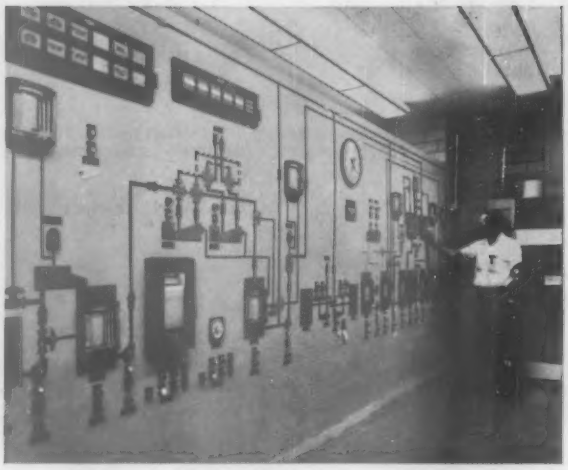

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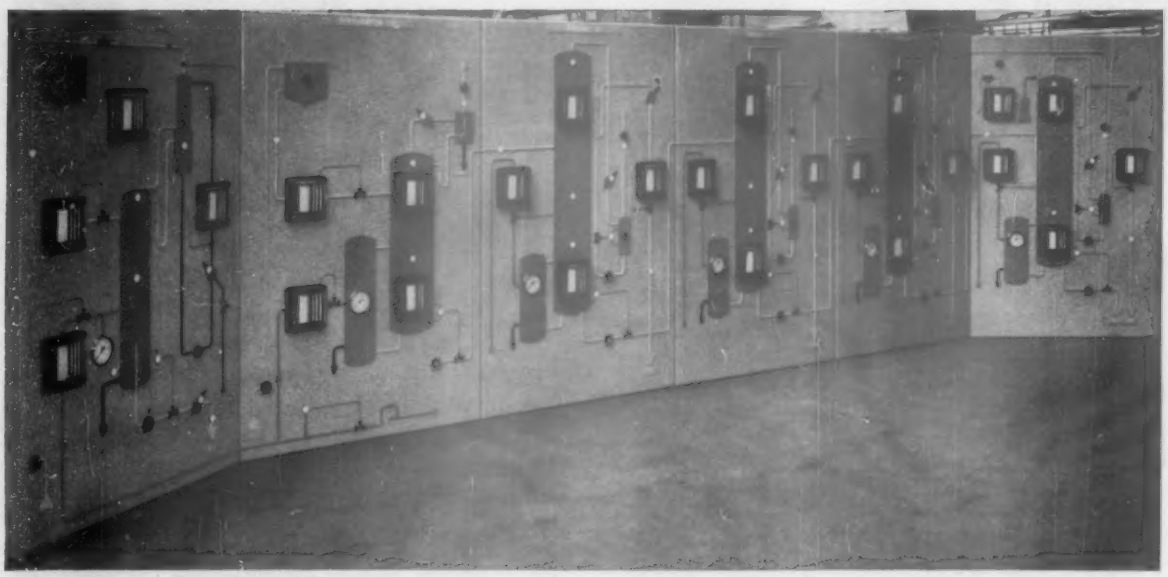

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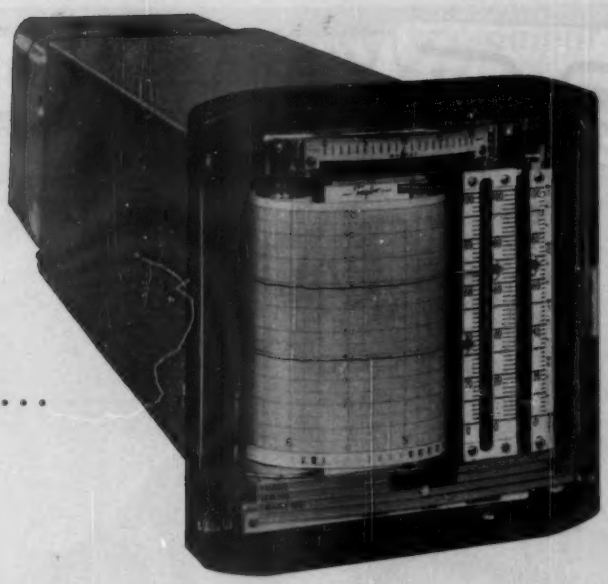

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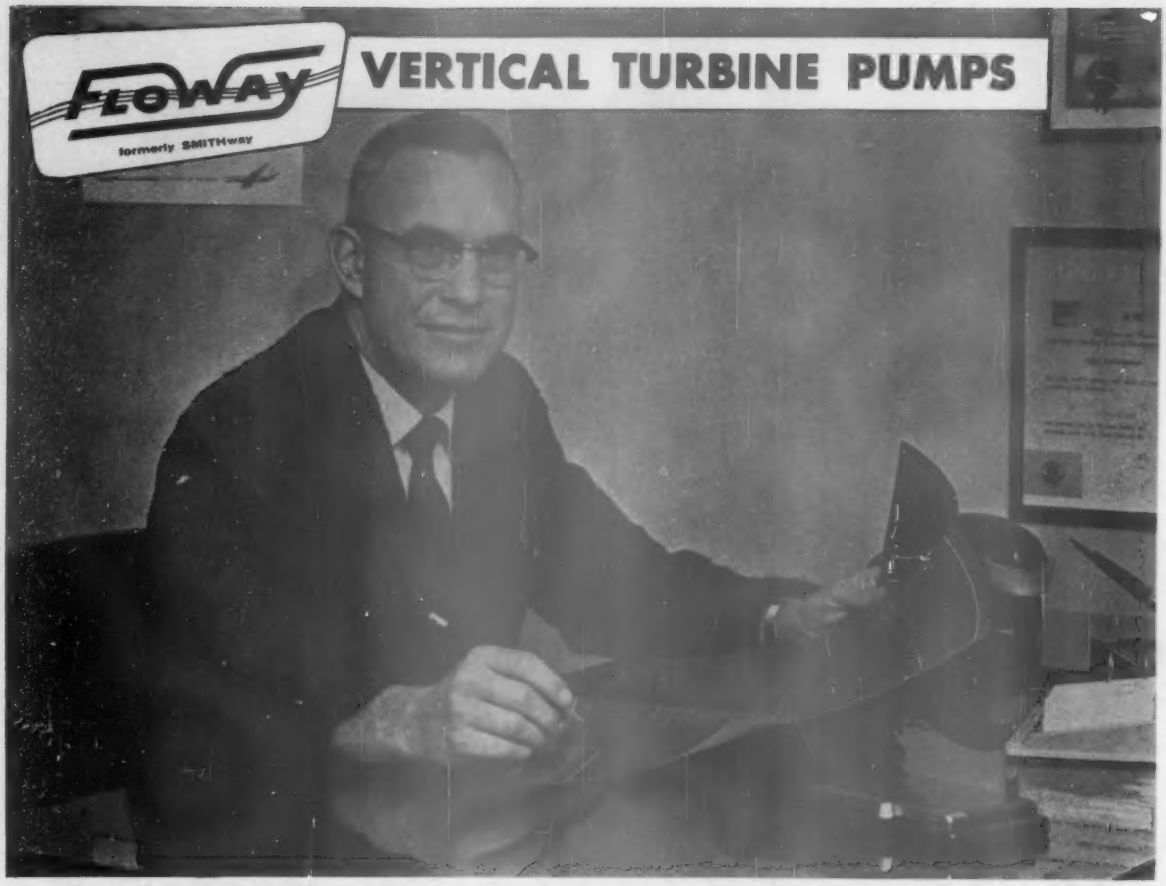

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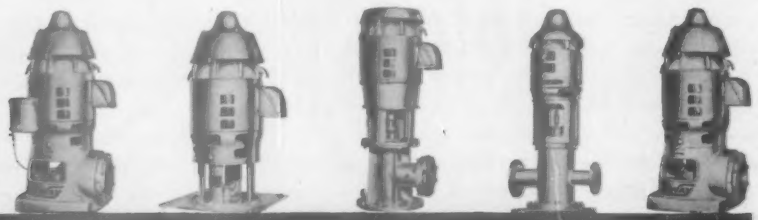

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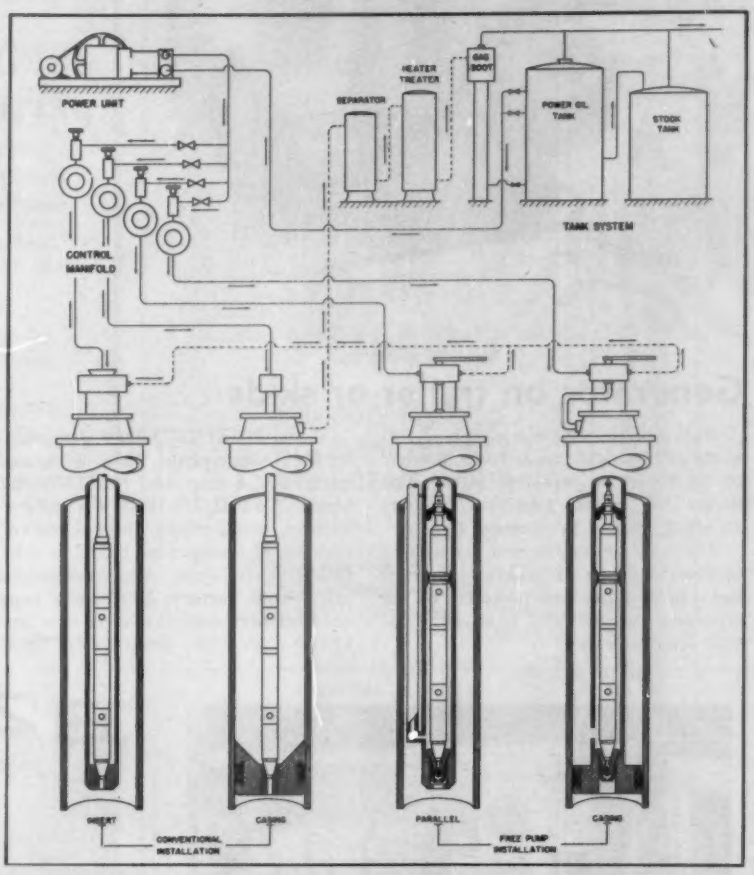
The Oilmaster unit is used in a well in conjunction with a power oil pump and a cleaning and storage system at the surface. Clean crude oil is directed down the well at relatively high pressures from a triplex pump. This gives reciprocating action to the subsurface hydraulic unit which pumps production oil to the surface.

The units are available for use in nominal 2, 2½, and 3-in. tubing with a choice of a conventional or a free unit in either small, standard, or large ratios. For the 2 and 2½-in. free units, you can choose between a universal or an oversize engine. The 2 and 2½-in. conventional units and the 3-in. units use a universal engine only. Delivery: immediate. Approximate net price, delivered, domestic, from $1,345 for a 2-in. unit to $2,465 for a 3-in. unit, both with universal engine. Source: **Fluid Packed Pump Co., Div. of National Supply Co., Los Nietos, Calif.**



SUBSURFACE PRODUCTION UNIT uses balanced design, is used with power oil pump and cleaning and storage system at the surface.

Measure volume

. . . with the Model 200 air-operated pycnometer, which lets you determine true volume as well as density, specific gravity, or porosity of solid materials, whether they be porous, granular, powdery, or irregular in form, according to the maker.

The instrument is based upon the principle that two closed systems of air at the same pressure and temperature will have identical specific volumes. It reportedly allows direct digital indication of the true or absolute volume of any solid substance with only a 1-minute procedure. Designed for field, laboratory, or plant use, the instrument weighs 16 lb. Sample containers may be 50 or 100 cc. Readout can be in cubic centimeters or cubic inches. Availability: 30 days. Price: about $450, f.o.b. factory. Source: **Houston Instrument Corp., Box 22234, Houston 27.**

Want more facts about equipment or copies of product literature described in this issue?

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Product name, Model no., literature title or number: .....

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Described in OIL AND GAS JOURNAL - Issue of April 18, 1960

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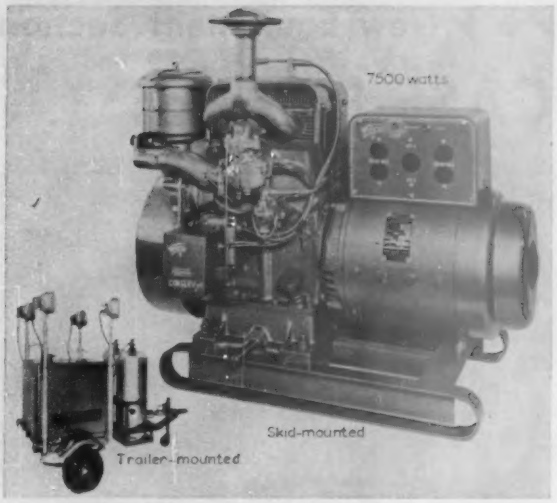


Generator on trailer or skids

. . . is available that can supply 7,500 watts of electrical power for a number of portable or standby jobs. The Series 705 engine generator features an idling control to conserve fuel.

The trailer-mounted unit is designed to meet a range of generator capacities. Both types are powered by an air-cooled engine and have 115/230 volt receptacles.

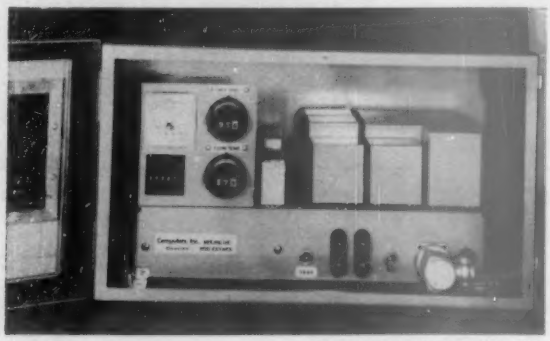
Model 705THD2D-3M9 is manual-starting, single-phase, three-wire, and rated at 32.6 amp. and 115/230 volts. Model 705THD2D-3ESM9 is electric-starting, single-phase, three-wire, and rated at 32.6 amp. and 115/230 volts. Delivery: 10 days. Approximate list price, f.o.b. factory: $998 for a manual-start unit with skid-type base and $1,098 for an electric-start unit.

Source: **Wincharger Corp., Sioux City 2, Iowa.**

Colored smokestacks

. . . which are glass-protected are available to enhance the looks of plants. The steel smokestack is lined inside and out with a richly colored acid-resistant glass. A variety of custom colors is available.

The manufacturing process permanently fuses brightly hued color dyes into the stack's glassed exterior. Extreme temperature and weather conditions reportedly have little or no dulling effect on the colored glass. The glass, as used in the stack, pene-



Flow Measuring System—Model 257

ACCURATE GAS FLOW MEASUREMENT WITH LOCAL OR REMOTE DIRECT READOUT

- Fast response
- High accuracy
- Plug-in components for easy maintenance
- A.C. or D.C. models available
- Integrated volume in cubic feet
- Instrumented for use with single orifice plate or multiple meter runs
- Flow rate indication

To learn more about modern gas flow measurement for automatic well testing, gas lift, sales and purchase, contact

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The First Accurate PRESSURE GAUGE! For Applications Requiring . . . RUGGEDNESS and DEPENDABILITY

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- casing swabs
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MACCO

MACCO CASING PRESSURE OPERATED GAS LIFT VALVES

Conventional Outside Mounted CM2 Intermitting or Continuous Flow Valve

INTERMITTING . . . This type valve is normally used in wells with producing capacities up to approximately 350 barrels per day. Fluid is lifted intermittently as "slugs" in relation to the producing capacity of well. A large volume chamber in the stem makes the valve "snap acting," thereby operating at peak efficiency. Frequency of intermitting cycles is controlled by a surface intermitter or casing choke.

CONTINUOUS FLOW . . . For wells in the continuous flow range, this type valve is equipped with various scientifically designed port sizes to meet the requirements of the individual gas lift installation. In most installations, the only surface equipment required is a choke in the casing input gas line.

Macco pressure operated intermitting and continuous flow valves are available in CM2 (1½" O.D.) for standard installations and CM1 (1" O.D.) for "slim hole," parallel string or concentric string installations.

For further information write for Brochure Nos. 2-12A, 2-12B and 6-12.

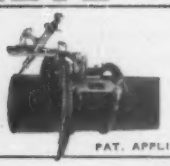
MACCO OIL TOOL COMPANY, INC.

1521 Prince **P. O. Box 7288** **Houston 8, Texas**

Phone UN 1-1253

H&M PRODUCTS FOR PROFITABLE PIPE CUTTING AND BEVELING

STD. MACHINES



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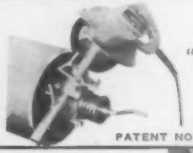
FAST, accurate cutting and beveling of all sizes of pipe from 1½"-36". Simple operation . . . operator can master machine in a matter of minutes.

"BEVEL-LAND" GRINDER



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No more time consuming handwork. "BEVEL-LAND" smooths pipe cuts and accurately places the lands on bevels in a matter of seconds.

OUT-OF-ROUND

Insures even, accurate cuts of irregular pipe. Roller rides pipe surface . . . makes cutting easy, simple. Fits all H&M Machines.

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SHAPE CUTTER

Accurately cuts saddles, tees, els and other irregular shapes. Lightweight, extremely portable . . . fits all H&M Machines.

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SHOWCASE . . .

New Equipment

trates and bonds with the steel under two applications of 1,600° F. heat.

According to the maker, the stacks should offer a life span of three to five times that of plain steel stacks in similar service. Operating temperatures range to 750° F. for maximum continuous duty. The glass coating weighs about 5 oz. per square ft. inside and out compared to conventional linings (inside only) of up to 50 lb. per square ft. No field welding is required as the sections bolt together. Delivery: 8 weeks. Approximate price, f.o.b. factory: from $4,000 for a 3-ft.-diameter by 60-ft.-high stack to $8,000 for an 8-ft.-diameter by 60-ft.-high stack. Source: **A. O. Smith Corp., Milwaukee 1.**

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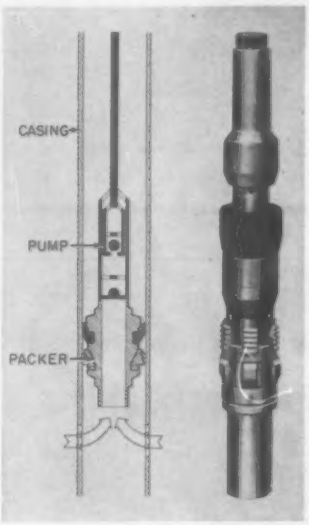
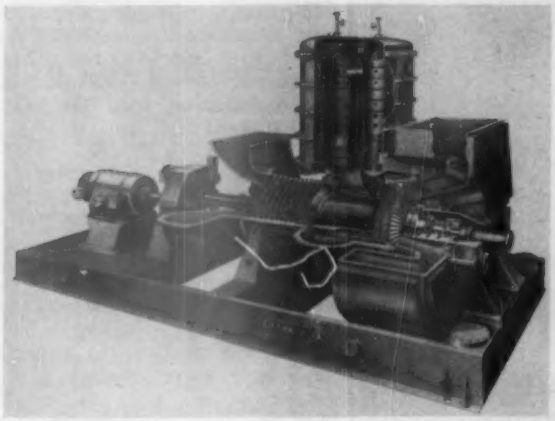


Casing pump packer

. . . is now offered which, the maker claims, requires no setting tool and needs neither tail pipe or setdown weight to maintain packoff. The one-trip packer is expected to prove especially suited to applications where a high volume of high-cut oil is to be pumped without tubing.

To run in, the packer is made up on the pump and both the pump and packer run in on the sucker rods. Thus no separate trip is needed to set the packer. Setting is accomplished through a J-slot mechanism. Once the packer is set, and pumping begins, packoff is maintained by hydrostatic pressure differential. The packer comes in three sizes for casing sizes from 4½ to 7 in. Source: **Baker Oil Tools, Box 2274, Terminal Annex, Los Angeles 54.**



A 9,000-hp. gas turbine

. . . with single shaft has been developed. The Model 305-S turbine has been designed to achieve substantial savings in initial cost, transportation, floor space, foundation, and installation expense. It will burn either liquid or gas as fuel, and is capable of continuous operation under full load at normal rated speed of 5,000 r.p.m. At rated speed, the unit's axial compressor delivers a mass flow of 135 lb. per second. To maintain long service life, the turbine's inlet temperature is held under 1,400° F.

The turbine is air-cooled. Pressurized air is bled off the axial compressor to cool the high-temperature components. The three-stage turbine, which supplies power to drive the compressor and load, incorporates a high-efficiency volute and rotor of builtup forged-steel disk design. Source: **Clark Bros. Co., Olean, N. Y.**

Digital computer

. . . for control of industrial processes is a fully transistorized machine. The LN-3000 computer is part of a system for process control and data processing. When used for on-line data reduction and calculation of operating guides, the system for which the computer is a part will provide open-loop control. It receives electrical signals or inputs from various variables and then automatically solves the algebraic relationships which exist between the variables.

The computer is a general-purpose, serial, internal binary, fixed-point, stored-program type. This means that it will handle all information internally as binary numbers, one bit at a time, but both its input and output are in ordinary numbers. The stored-program feature enables the computer to operate on the basis of predetermined sequences. Source: **Leeds & Northrup Co., 4901 Stenton Avenue, Philadelphia 44.**

●

Plug valve

. . . for drilling, cementing, and oil and gas production is available that has a thrust bearing which is lubricated for life at the factory and sealed in. No lubrication is required for the valve in service. The valve has a quarter-turn, round hole, full area.

In cementing service, the Shaffer-Tanner PV Model valve may be thoroughly cleaned without disassembly. Merely open and close it slowly five or six times while a cleaning agent is being pumped. The valve is designed to operate either fully open or fully closed. Working pressures range from 3,000 to 5,000 psi. Available sizes range from 1 to 4 in. Approximate net price, f.o.b. factory: from $76 for a 1-in. valve with a 3,000-psi. working pressure to $550 for a 4-in. valve with a 5,000-psi. working pressure. Source: **Shaffer Tool Works, 209 South Pomona Avenue, Brea, Calif.**

●

Pressure-control

. . . pilots are now available from stock for use in conjunction with gas-lift intermitters and flow-line controllers or stop cockers as multipurpose assemblies. The TPC (for tubing-pressure cutoff) pilot assembly contains a bourdon-tube actuated nonbleed snap-acting pilot valve which may be adjusted to close a motor valve at a predetermined increase or decrease of tubing or casing pressure, independently of the time-cycle pilot.

The pilot and case are of anodized aluminum and stainless-steel construction. The assembly is attached to a time-cycle pilot case for mounting on a motor valve. The action of the bourdon tube and pilot-valve trigger may be watched through a glass-covered observation port in the case. The setting of the bourdon-tube pressure cutoff point may be easily adjusted in the field to any desired point. Source: **Macco Oil Tool Co., Inc., 1521 Prince Street, Box 7288, Houston 8.**

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Product name, Model no., literature title or number: .....

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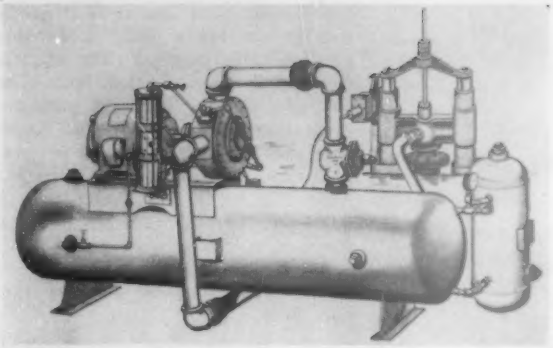
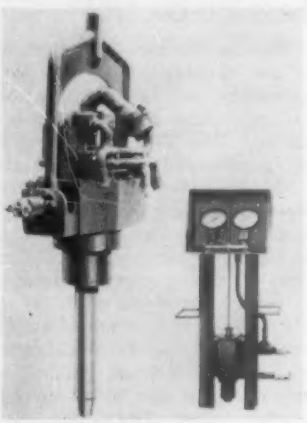


Hydraulic circuit on pumping unit

. . . now being marketed is completely closed and independent of the well fluid. The Fluid Power pumping unit uses compressed air above the hydraulic fluid, in a common accumulator tank to maintain balance of the rod load. The hydraulic rams mount below ground level to reduce over-all height and provide quick access.

A vane type of reversible hydraulic pump, designed to "soften" the reversing action of the rams, is used. When needed, the power fluid is lubricated into the system through a small tank connected to the main accumulator. Source: **Fluid Power Products, Inc., 2763 Cherry Avenue, Long Beach 6, Calif.**



Power swivels

. . . shown here are designed for shallow drilling, deepening of slim holes, coring in cable-tool holes, and general workover. The swivel acts as the prime mover for rotating pipe.

According to the maker, it can be operated in a derrick or mast of any design which will support the weight of the drill pipe or tubing. An advantage of the swivel over conventional drilling equipment is that it eliminates the need for a rotary table, kelly, and conventional swivel. The drive consists of integral twin hydraulic motors powered by oil delivered through a hose from a truck or skid-mounted power unit. Through the controls, you can operate it from the rig floor or at a location away from the wellhead. Source: **Hycalog, Inc., Shreveport, La.**

Blast-joint

. . . protector for tubing is available that is a lightweight high-temperature, high-impact plastic, permanent blast-protective sleeving for steel tubing strings in multiple-completion oil and gas wells in those areas subject to blast from casing perforations.

The protector is fitted to the exterior walls of steel tubing. According to the maker, the protector is compounded to offer protection at temperatures up to 285° F. and pressures up to 12,000 psi. The protector comes in the maker's standard thicknesses of ⅛ and ¼-in. on steel tubing in an o.d. range of 1¼ through 4 in. and in continuous lengths to individual requirements. Approximate price, f.o.b. factory: $15 to $20 per linear foot, depending upon quantity. Source: **Grigsby Brothers, Inc., Box 482, Lafayette, La.**

●

New diverter valve

. . . available provides operating flexibility and low maintenance, according to the maker. The TPOR-1 valve is a three-way, two-position type for low-pressure automatic well-testing systems or others where it is necessary to divert flow. The valve has an 8-in. diaphragm and a relatively large flow capacity. In the maker's standard 2-in. valve, the opening is 1.77 sq. in.

The valve has a bonded soft seat for tight sealing. All internal parts can be taken out from the top. Exposed parts are of stainless steel. Delivery: immediate. Approximate net price, f.o.b. factory: $90 for a 2-in. size. Source: **Garrett Oil Tools Div. of U. S. Industries, Inc., Box 2427, Longview, Tex.**

●

Casing perforator

. . . perforates 2⅜-in. casing. Called a Ribbon Jet perforator, the 1 11/16-in. jet provides a solution to the problems of perforating 2⅜-in. casing in both single completions and in multiple completions where orienting is required.

The new tool approaches the two problems of perforating 2⅜-in. casing by a compromise between complete elimination of debris and high level of gun powder. Shot densities up to four shots per foot are obtainable. Pressure-temperature rating is 5,000 psi. at 250° F. Source: **Schlumberger Well Surveying Corp., Box 2175, Houston.**

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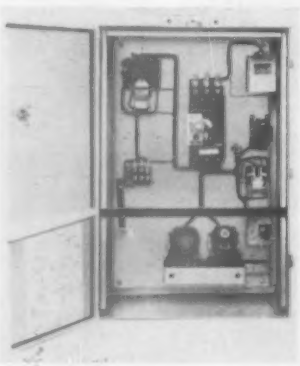


Protection

. . . for oilwell pump motors is offered by a new control unit. It is a three-phase 60-cycle 220/440-volt a.c. control unit for use on motors rated from 3 to 100 hp., NEMA sizes 0 through 4.

One feature of the controller is a new three-pole relay that protects against locked rotor, single-phase starting and running and normal overload. According to the maker, the relay is insensitive to changes in ambient temperature. It can thus prevent nuisance trips. A three-phase lightning arrester handles surges commonly encountered. Its surge capacity is 10,000 amp. To aid the operator, a copy of the wiring diagram is mounted inside the lower door. The control is available from stock. Approximate price, f.o.b. factory: from $235 for NEMA size 0, 3 hp. to $750 for NEMA size 4, 100 hp. Source: **Westinghouse Electric Corp., Box 2278, Pittsburgh.**

SHOWCASE . . .

New Literature

Seismograph system

. . . known as G-22A—a modern high-production vehicle-mounted system useful where wide-range signal-handling ability and extensive filtering flexibility are required—is described in a new bulletin. According to the literature, special amplifier circuitry and control unit design provide outstanding performance with magnetic or photographic recording media, and allow selection of a variety of control factors for optimum record presentation. Source: **Southwestern Industrial Electronics Co., P. O. Box 22187, Houston 27.**

Speed-reduction

. . . methods with compact, shaft-mounted units in a wide range of sizes and horsepowers, are described in a new 64-page bulletin. Besides describing Torque-Arm speed reducers for mounting on shafts of driven machines, Bulletin A692 also presents reducers for flange mounting, vertical shafts, right-angle drives, and screw-conveyor drives.

Construction details, dimensions, prices, and installation information are given in sections illustrated with photos and engineering drawings. Tables are included to simplify selection of reducers for various applications, power requirements, and output speeds.

One section is devoted to screw-conveyor drives, consisting of reducer, packing gland, and drive shaft, which mount as a unit on screw-conveyor-trough ends. Source: **Dodge Mfg. Corp., Mishawaka, Ind.**

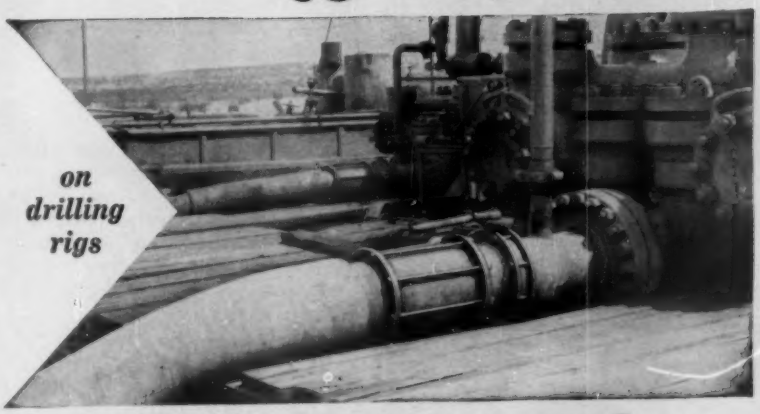
Stockpiled asphalt

. . . can be heated and remixed with a handy tailgate asphalt mixer, as detailed in a new publication. The 4-page illustrated brochure describes the Heat-A-Mix mixer. Source: **Wylie Mfg. Co., Inc., P. O. Box 7086, Oklahoma City 12.**

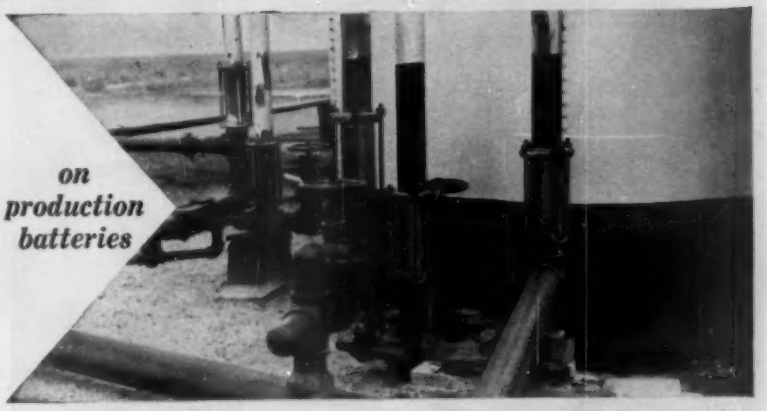
Auxiliary crane

. . . and hoist control instrument—called Hydra Set—is illustrated and described in a new four-page literature piece. Bulletin H-21 is complete with application photographs and descriptions, illustrations of various functions of the instrument, and a discussion of its operation and general specifications. Hydra-Set is a closed

Dresser® Couplings—



fast, vibration proof...



safe, permanent joints!

Dresser Couplings are easily installed . . . only two man-minutes per bolt with a simple hand wrench. The specially compounded Dresser Gasket provides the essential "give and take" to absorb vibration, settlement, and other stresses that might cause damage. It also allows up to 4° pipe deflection at every joint and still maintains a permanent, bottle-tight seal. Eases of take-down and re-usability of Dresser Couplings are a tremendous asset where you may need to add new pumps, valves or lines. Send for Dresser Catalog No. 531. It contains more detailed information and complete specifications on *all* Dresser Couplings, Fittings and Pipe Repair Products.

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DRESSER MANUFACTURING DIVISION

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circuit, hydraulically operated instrument that installs between any crane hook and the load.

The literature reports that it requires no external power to operate and will raise or lower loads up to 100 tons a distance of 12 in. with an accuracy of 0.001 in. Source: **Mefco Sales & Service, Inc., 131 North Fifth Avenue, Arcadia, Calif.**

Natural-gas-engines

. . . booklet traces the development of the engine and shows model views, specifications, and fuel-consumption curves of new models. Eight-page Booklet 20173 offers photographs and job stories illustrating actual performance of the engines in drilling rigs, gas compressors, pipelines, gas separations, along with electric, standby, and other installations. Source: **Engine Div., Caterpillar Tractor Co., Peoria, Ill.**

Cathodic-protection

. . . rectifiers of selenium and silicon types are detailed in a new 6-page folder. It presents features and advantages of the rectifiers, along with pictures, dimensions, and a schematic drawing. Specifications detailed include input, meters, circuit protection, voltage selection, rectifier, transformer, terminals, construction, mounting provisions, and weather protection. Source: **Lester Equipment Mfg. Co., Inc., 151 West Seventeenth Street, Los Angeles 15.**

Two fuel additives

. . . trade-named Tolad are outlined in a 4-page brochure, yours for the asking. The additives include: (1) the inhibitor or preventive type, said to be most effective for fuels intended for use in domestic heating units; and (2) inhibitor-dispersant type, preferred for diesel fuels. The brochure incorporates graphs, tables, photographs, and photomicrographs. Source: **Tretolite Co., 369 Marshall Avenue, St. Louis 19.**

Jet perforators

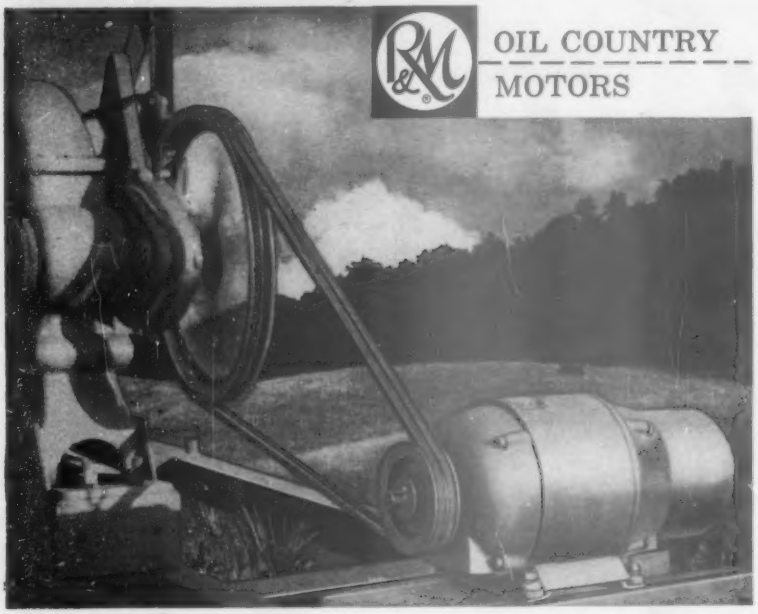
. . . Technical Service Report T-4501 describes a small-diameter, expendable perforator for through-tubing and slim-hole completions. The perforator features an enclosed firing system, deep carrot-free penetration, breakup characteristics, and a high well-flow index. The report also includes a chart giving specifications and performance data. Source: **McCullough Tool Co., 5820 South Alameda Street, Los Angeles 58.**

Pipe locator

. . . known as Signalmaster Model TR-1A is discussed in a new 2-page data sheet available now. By a simple manipulation, the transistorized locator can be used to trace nonmetallic pipelines, the literature reveals. Features of the new instrument described include sensitivity, weight, accuracy, versatility, ruggedness, costs, parts, and simplicity. Source: **Goldak Co., Inc., 1544 West Glenoaks Boulevard, Glendale 1, Calif.**

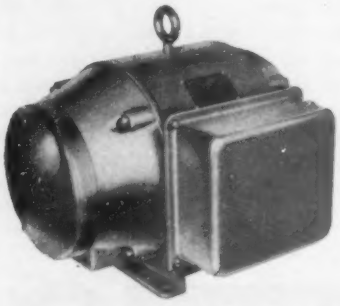
Special fabrications

. . . brochure has recently been published in a 20-page form. Among products described are new Lightning rig-skidding equipment, a pipe and kelly straightener, various hydraulic-jacking mechanisms, dual-purpose bins serving for transportation as well as for pipe racks, mud tanks and systems (including special cleanout arrangements for tanks), work benches, tool houses, rigup for export, and stiff-leg derricks. Source: **Joe Stine, Inc., P. O. Box 14471, Houston 21.**



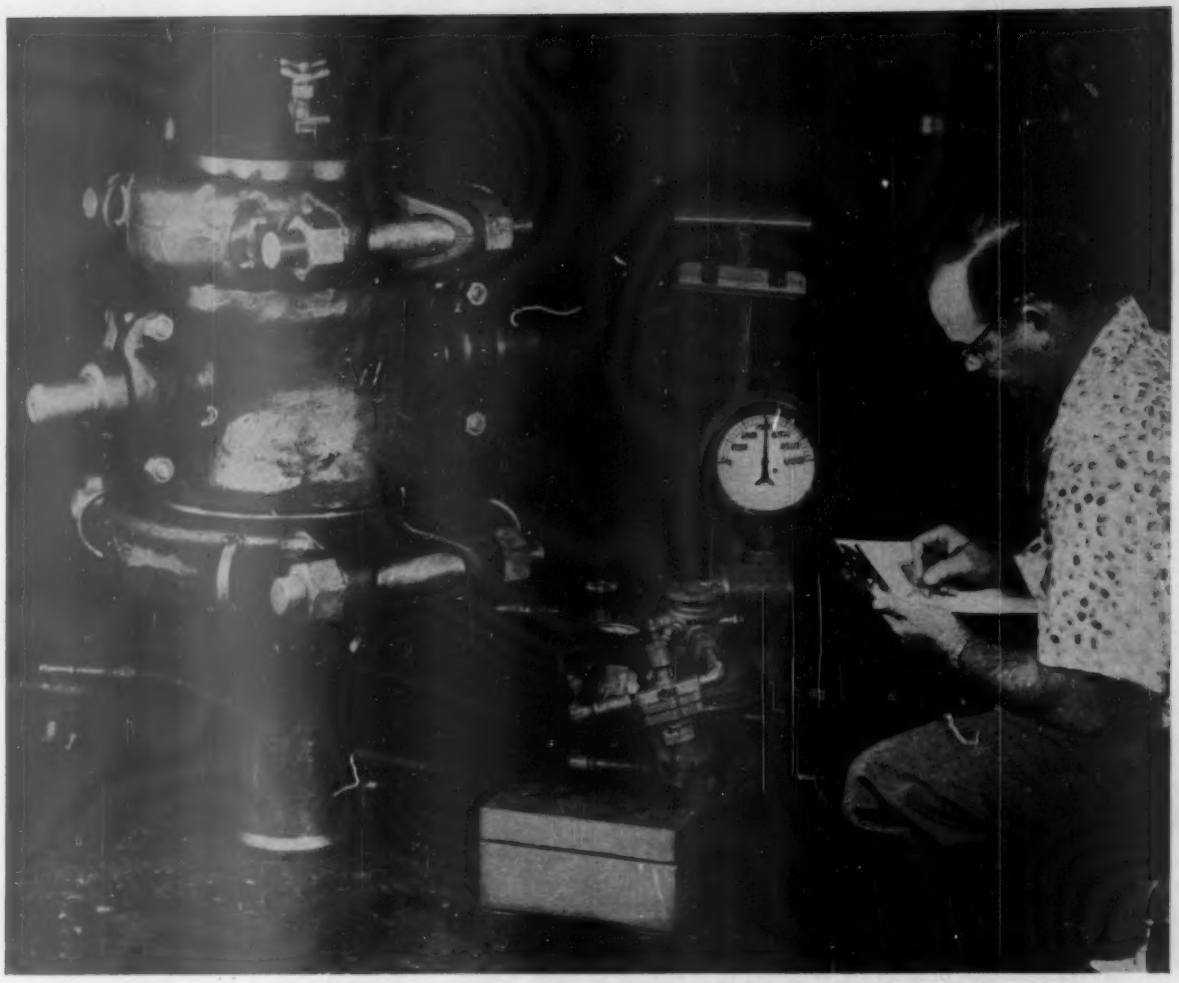
REMOTE LOCATIONS *need*
Maintenance-Free R&M Motors!

New Robbins & Myers
Single Phase *"All Weather 40" Oil Country Motors*



Ratings up to 20 HP, eliminate maintenance and constant attention when they replace internal combustion engines in remote areas. Motors are fully weatherized against moisture, dirt, heat. Auxiliary mechanism is externally mounted for simple inspection, even while motor is running. For reduced current starting, sizes above 7½ HP (10, 15, 20 HP) have unique *"cushion start"* system available as extra-cost option. Write for Bulletin 470-OG

ROBBINS & MYERS, INC.
MOTOR DIVISION • SPRINGFIELD, OHIO



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Every Gray well head component, as well as the assembled christmas tree, is forced through tests that exceed the demands of field applications. One situation is an internal pressure test: pressures up to 30,000 psi are applied. Gray's testing laboratory is your assurance that each component will fulfill the requirements of your well drilling and completion plans.

For more information about Gray well head assemblies and Gray Systems of Well Control, write today for your copy of the Gray Catalog.

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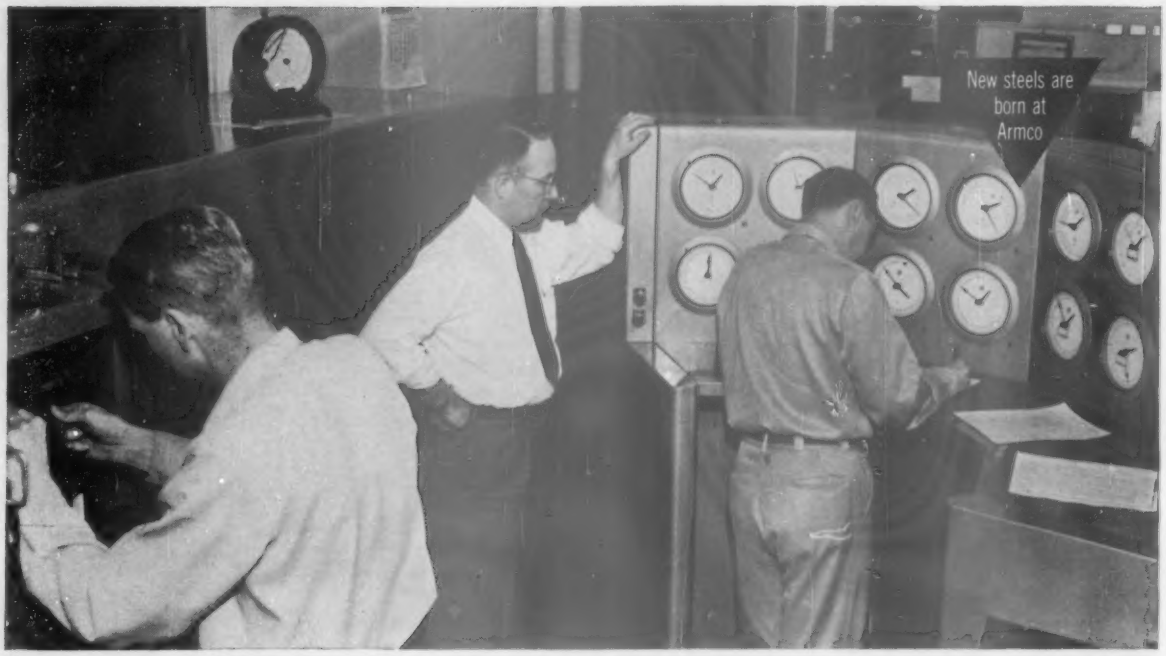

How Sheffield alloy steels "show their colors" in quality control tests

In 60 seconds the instrument shown above reports the exact percentages of alloying elements in a sample of steel. Does it by analyzing the color spectrum of the metal.

Called the Direct-Reading Spectrometer, this is one of many advanced testing instruments and techniques which assure precise quality control of Sheffield alloy and carbon steels.

It's mighty important, when you consider that the slightest deviations in metallurgical make-up, time, temperature or atmosphere during steelmaking can render an alloy steel unfit for its intended use.

If you're a manufacturer using steel, you'll find in the Sheffield alloys the right metal for making better products at lower cost. Sheffield's continuing expanded steelmaking and heat-treating facilities — and nearby locations — give you buying advantages worth learning about. Get in touch with us at Houston, Texas.

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Alloy and carbon steel billets, beams, plates and rods. Tankheads and hot rolled merchant shapes. Bolts and wire products. Many other semi-finished and finished steel products.

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OTHER DIVISIONS AND SUBSIDIARIES: Armco Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products

▶ ▶ ▶ Equipment Men Notes

Western Co. establishes

. . . a Rocky Mountain division with offices in Farmington, N. M., to offer nuclear logging, perforating, fracturing, and acidizing services throughout the Four Corners area. At the same time, a new Farmington district station is being set up 8 miles from the city.

Harold Parsons

W. H. Dennis

Harold Parsons, former assistant Oklahoma City division manager, assumes duties as Rocky Mountain division manager and William H. Dennis becomes manager for the Farmington district. Parsons, who has been with Western since 1948, was named assistant division manager at Oklahoma City early last year. Dennis, an 8-year company member, has served as district manager at Healdton, Okla., and at Cortez, Colo.

W. Leo Cypher assumes title

W. L. Cypher

. . . of district sales manager in the Rocky Mountain area for Baash-Ross Division of Joy Mfg. Co., reports R. A. Forsman, director of sales and service. Now locating in Denver, Cypher previously was special sales representative covering both domestic and foreign areas out of Long Beach, Calif. He joined Baash-Ross in 1937.

Watson is sales representative

. . . in West Texas for Well Equipment Mfg. Corp., according to John W. Gates, vice president and sales manager. Blackie Marshall, of Odessa, Tex., will continue in his present capacity, thus giving Weco two representatives in that part of the state.

Jarvis Watson, who has completed a training program at Weco, has had 3-years sales experience for a rock-bit manufacturer. For the past 5 years, he had been sales engineer for a service company.

Gates further announced that W. C. (Bill) Meeks, sales representative for Chiksan-Weco oil-industry products in the Rocky Mountain area for the past 2 years, had been transferred from Denver to Dallas to serve the Dallas-North Texas area.

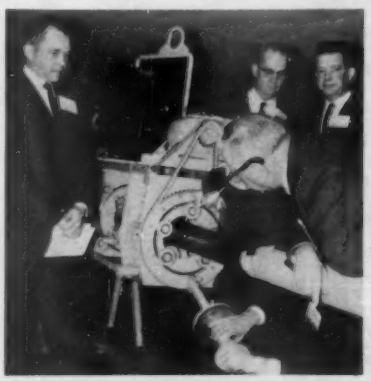
Baroid appoints B. R. Fry

. . . as superintendent of the drilling-mud district covering 6 southern states with headquarters in Jackson, Miss. Fry joined Baroid Division of National Lead Co. in 1948 in well logging and was made a drilling-mud service engineer in 1952. Since 1956 he has worked in Liberal, Kans. as district superintendent and in Tulsa as a sales representative.

Baroid also announced the appointment of Rex Haile as sales representative in the company's East Louisiana area, with headquarters in New Orleans. Haile recently returned from a foreign assignment.

Dillard R. Thomas is appointed

. . . sales manager of the Eastern Hemisphere for Reed Roller Bit Co., Houston, announces W. E. Scarborough, vice president of sales. Thomas, who only recently had returned to Reed as Scarborough's administrative assistant, will make his headquarters in London, England. In his capacity he replaces John Orton who resigned.



POLYETHYLENE tape-protection system, introduced by Chase & Sons, Inc., North Quincy, Mass., was shown to southwest pipeliners recently at a demonstration in Tulsa. The system consists of a rubber-resin-based primer, the polyethylene tape, and an asphalt-impregnated reinforced paper outer wrap, all applied by a Remco Mfg. Co. machine which also cleans the pipe. Shown at the demonstration are (left to right) H. Sam Aubrey and W. C. Myers of Myers-Aubrey Co., Tulsa, representatives for Chase & Sons in Oklahoma and southern Kansas; B. A. Stephanus, Chase & Sons; and, in the foreground, A. M. Hill, Service Pipe Line Co.

Schlumberger names J. Oberle

. . . location manager at Fairmont, W. Va. succeeding E. C. Bevins. Oberle was previously field engineer general at Effingham, Ill. Bevins now moves to the company's northeast division as senior sales engineer.

J. W. Carpenter and E. E. Kauffman have been named sales engineers at Tyler, Tex. and Pratt, Kans., respectively. Carpenter formerly served as field engineer general at Tyler, while Kauffman held the position of special-services engineer in the company's Kansas division.

Republic Supply Co. makes

. . . the following promotions and new appointments which were announced by W. J. McWilliams, president and general manager: J. F. O'Neill, former assistant to the general sales manager, appointed manager of the tubular sales department; J. W. Brackett, named administrative assistant to the general sales manager; W. R. Chafin, Jr., purchasing agent replacing Brackett; and Paul S. King, manager of the merchandising and materials division.

J. F. O'Neill

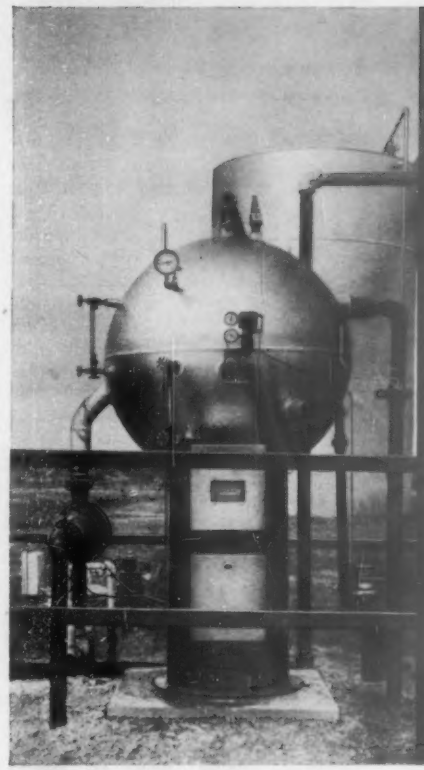
J. W. Brackett

Welex, Inc. combines

. . . its Louisiana Gulf Coast and its Texas Gulf Coast divisions into a single Gulf Coast division under the managership of W. L. Laflin, who moves from New Orleans to Houston.

Promotions and transfers within the new division include: Gilbert Hester, from Houston sales engineer to Houston district manager; G. E. Johnson, from Alice shooter to Corpus Christi district manager; J. R. Evans, from sales engineer to district manager at Alice; W. R. Marshall, from sales engineer to division operations manager at Houston; C. E. Eicke, from logging operator to sales engineer at Houston; R. K. Riggle, from Mission field engineer to Beaumont sales engineer; C. F. London, from field engineer to assistant district manager at Alice; and W. R. Riggan, from Lafayette field engineer to assistant district manager at Victoria.

At Welex's Research & Engineering



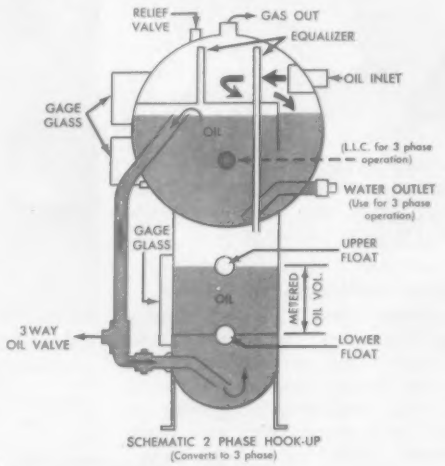
TYSCO

the spherical metering separator with built-in utility

. . . easily converts from 2 to 3 phase.

A standard 2 phase Tysco Spherical Metering Separator not only records oil volume accurately and separates oil and gas efficiently, but, by simply adding an interface controller and control, it is easily converted to a 3 phase unit for separating oil, gas, and water. Internal baffles assure minimum turbulence and maximum operating capacities. Each unit is equipped with a non-bleed, 2-float meter switch, field-proven to give dependable performance even on paraffin service. The overall size and low silhouette of Tysco Spherical Metering Separators reduce space requirements, installation time, and handling problems.

For full information on Tysco metering equipment: Spherical or Vertical Metering Separators (2 and 3 phase) and Metering Vessels (for metering liquids as a subsequent operation to existing equipment) contact your local Tysco sales engineer, or write:



SCHEMATIC 2 PHASE HOOK-UP
(Converts to 3 phase)

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SALES OFFICES: Corpus Christi, Dallas, Houston, McAllen, Odessa, and San Antonio, Texas; Lafayette and New Orleans, Louisiana; Laurel, Mississippi. **EXPORT SALES:** Ideco, Inc.

One of the Smith Industries

Serving Industry With Quality Products, Dependable Service.

Center in Houston, R. H. Huddleston, former senior development engineer, was named manager of research and engineering. Other changes involve: G. T. O'Bannion, from Ventura division engineer to R&E training instructor; and D. L. Divine, from Beaumont trainee to R&E engineer.

Recent changes in the Oklahoma division include: R. R. Lovely, from logging operator to field engineer at Liberal; J. W. Webb, from shooter to sales engineer at Pauls Valley; W. M. Clover, from Oklahoma City field engineer to Pauls Valley sales engineer; Division Sales Manager R. B. Burns from Tulsa to Oklahoma City; and M. F. Rockwell, from Bristow shooter to Shawnee sales engineer.

Recent transfers affect: J. W. Pickering, from Hays district manager to Tyler district manager; and C. D. Hendricks, from Farmington rigman to Kimball sales engineer.

Aaron D. Baker is appointed

A. D. Baker

. . . assistant to the executive secretary of the Association of Oilwell Servicing Contractors. In this capacity he will sell the idea of improved well-servicing methods and well-servicing safety among the association membership. He will assist James E. (Jim) Danheim, executive secretary, and will act as field representative for the organization.

Baker, who began his oil-field career in 1917, is a retired Humble Oil Co. employe. He was formerly safety engineer for Dapsco, Inc., of Laurel, Miss.

Republic Supply makes changes

. . . in field personnel, reports C. J. Jump, general sales manager.

K. L. Maxwell has been transferred to Denver as sales-office representative under R. A. Prater, district manager. Maxwell previously was manager of the company's store at Casper, Wyo. Succeeding Maxwell is Rex M. Casteel who most recently was head floorman and field sales representative in Farmington, N. M.

Cecil R. Hines has been promoted to manager of the Odessa, Tex. store under H. L. (Jelly) Ellis, West Texas manager. For several years Hines served the area in and around Odessa after starting with Republic in 1946. F. H. Anthis has joined Republic's Tulsa office as sales-office representative. He has served the company at Cement and Elmore City, Okla., as well as at Wichita Falls, Tex.

Bernard F. Klein becomes

. . . head of the newly created Industrial Division of Wade Advertising, Los Angeles. Klein is considered a specialist in the engineering and technical-advertising field, with emphasis on the petroleum industry. For the past 7 years he was account supervisor for Halliburton Oil Well Cementing Co.

The announcement was made by Forrest F. Owen, Jr., Wade vice president in charge of the Los Angeles office. Owen explained that establishment of the new division is part of Wade's recent expansion program, which has included additional staff members and departments.

Oil Center Tools Co. acquires

. . . a part interest in Luceat, S.A. of Sens, France as part of the Houston firm's long-range program for increased participation in international trade.

O-C-T's interest in Luceat will be a joint responsibility with FMC International, a division of O-C-T's parent company, Food Machinery & Chemical Corp. FMC International handles

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FOR PIPELINES, REFINERIES, GASOLINE PLANTS
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Wherever the specific gravity of liquid products or processing fluids is an important factor Arcco-Anubis Liquid Gravitometers will render accurate recordings of continuous flow and spot checks of samples under varying conditions of temperature and pressure. Foreign liquids and gases are automatically purged. Changes in the specific gravity of the sample are recorded almost instantly. High pressure and high viscosity liquids are handled with ease. Charts graduated for specific gravity are available in over 100 ranges. Charts for Degrees A.P.I. are available in over 30 different ranges. Arcco Liquid Gravitometers are made for recording, controlling, indicating, transmitting and various combinations of these functions. Special charts when required can be furnished at slight additional cost.
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OIL FIELD PROVEN INTERNATIONAL
GET IN AND GET OUT,

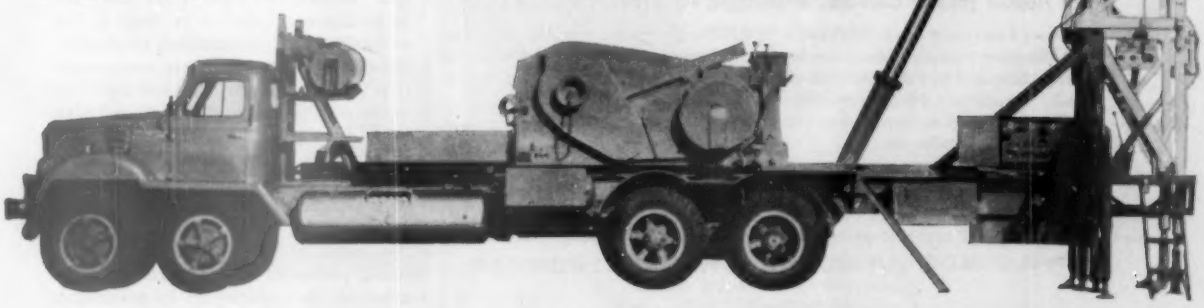
Six-passenger INTERNATIONAL Travelette® Pickups lead the hunt for oil. Seismograph and geological teams travel in an all-weather protected, factory-warranted cab from base to place . . . their equipment in the pickup body. The Travelette "takes" rugged country without sacrificing passenger comfort. True-truck V-8 engines are standard, "sixes" optional. Four-wheel-drive models available.

INTERNATIONAL V-8 powered truck-tractors "do" your marketing with higher average road speeds, highway economy and top pulling power off-road. Husky tandem axles get you going and keep you going from refinery to bulk plant with better weight distribution and flotation. Heavy-duty INTERNATIONAL V-8 engine choices offer up to 549 cu. in. displacement, 505 lb.-ft. of torque.

TRUCKS
GET UP–AND GO!

Four-wheel-drive INTERNATIONAL Trucks can move anything from pipe "gunk" and a load of valves to a rigging crew, through the "stickiest" fields. You get a wide selection of wheelbases to permit installation of the correct body lengths to fit your transportation need. Ideal for boom truck adaptation for winch work or pipe gathering. Choice of V-8 or 6-cylinder engines and matching power train for perfect unit-to-job balance.

Specially designed INTERNATIONAL Trucks help maintain every phase of oil field production. True-truck V-8 power, double tandems, and rugged chassis are ideal for bringing in a pulling unit or well-work-over equipment on the roughest terrain. Yet rig length and width is legal over-the-road in many states without a special permit. Mast roading dimensions telescope to 60-ft. long, 12-ft. high, 8-ft. wide.



INTERNATIONAL® TRUCKS WORLD'S MOST COMPLETE LINE

International Harvester Company, Chicago • Motor Trucks • Crawler Tractors • Construction Equipment • McCormick® Farm Equipment and Farmall® Tractors

the administration of a major portion of company export sales and coordinates the activities of overseas manufacturing operations.

Luceat, S.A. is a manufacturer of components for the industry. The French concern will produce a wide range of O-C-T wellhead equipment.

W. C. Norris adds Don Kyle

. . . to its staff as a sales representative. Kyle, formerly with Oil Well Supply in Gainesville, Tex., has been assigned to the Tulsa company's West Texas sales division. He will headquarter in Hobbs, N. M.

Continental-Emsco Co. promotes

. . . Noble D. Lane, former district manager at Lafayette, La., to division manager in Houston in charge of the South Texas division. Lane served as a floorman, field salesman, and store manager before being named district manager in 1953. He has been with the company 17 years.

The company also announced the promotion of Harry Hobbs, Jr., former division merchandise manager of the Houston division, to assistant general merchandise manager of the Dallas general office. Hobbs had been merchandise manager for the Houston area since 1957. He has served as a

N. D. Lane

Harry Hobbs

field salesman, drilling-equipment representative, and drilling-equipment specialist.

Other C-E promotions and transfers involve: James W. Dees, store manager at Houma, La., promoted to district manager for the Lafayette office; Leo R. Walker, Lake Charles, La., store manager, taking over merchandising duties for the South Louisiana division office; Al L. Beavers, Houston district production machinery specialist, now in charge of merchandising for the Houston division; Douglass P. Yadon, Jr., named division oil-country-tubular representative for the Tulsa division; and Dwight G. Barnhart, new district tubular representative in Columbus, Ohio.

Promoted to pump specialists are Ennis W. Smith, El Dorado, Ark.; James E. Yarbrough, Jr., Duncan, Okla.; B. R. Grieve, Houston; and Wilfred L. McWhorter, Luling, Tex. New store managers are Kermit A. Holden, Leeville, La., and Nealy Nevils, Jr., Lake Charles. T. C. Williams, former store manager at Leeville, takes over the Lafayette store. William F. Wheeler is the new division production-equipment specialist for the Los Angeles division office.

Walter M. Golden has been moved from Duncan to County Line, Okla., and Robert F. Gregg, division oil-country-tubular representative, from Tulsa to Denver.

A. O. Smith Corp. receives

. . . a $25,000,000 order from Michigan Wisconsin Pipe Line Co. for large-diameter pipe to be used in the extension and enlargement of the latter company's natural-gas transportation system. Smith officials said the order was for more than 600 miles of pipe, ranging from 16 through 30-in. in diameter. It's estimated that 140,000 tons of steel plate will be needed to complete its manufacture.

Michigan Wisconsin officials said that most of the pipe was scheduled for a proposed "looping" or enlargement of the capacity of its main line, which extends from the Laverne gas fields in Harper County, Okla. to Wisconsin and Michigan. The balance is slated for a proposed extension of natural-gas service to distribution utilities in Central Wisconsin.

Is your equipment going up in smoke too?

CPS Heater Treater Cathodic Protection will prevent this loss.

INTERNAL CORROSION of oil field equipment, handling produced brine, can be entirely eliminated by the application of soundly engineered cathodic protection installations. Vessel equipment does not wear out — it corrodes out.

Either your nearest CPS branch office or our home office is readily available for engineering consultation to . . . properly design your cathodic protection systems.

CPS Heater Treater cathodic protection equipment can be procured through your nearest Tank Company — our home office or any of our listed branches.

CPS has also been involved in the engineering and installation of cathodic protection of several thousand well casings and is presently engaged in the installation of cathodic protection on over 500 casings for a Unit Operator in West Texas.

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CORPUS CHRISTI 1620 S. Brownlee TUlip 3-7264
ODESSA 5425 Andrews Hwy. EMerson 6-6731

Barton Instrument Corp. reports . . . the establishment of a program of advance product planning and research to broaden the company's product base and develop new and wider business horizons. Heading the program will be Claude B. Nolte, vice president, who has filled varied roles for Barton during the past 15 years.

Burgess-Manning Co. reports . . . three promotions and assignments involving personnel in its Industrial Silencer Division in Dallas, Los Angeles, New York City, and Libertyville, Ill. Louis G. Halla has been promoted from a sales engineer to manager of the company's western district sales office in Los Angeles.

L. G. Halla

H. L. Harris

Two men have been promoted in the company's southern district sales office in Dallas. H. L. Harris is the new manager, and G. R. Packer, former sales coordinator, is now a sales engineer. The firm also announced that Albert J. Stella, Jr., has joined the company as a sales engineer in the eastern district sales offices in New York City. The Libertyville district sales office will continue to be directed by F. C. Duerr, district manager, and R. F. Anderson, sales engineer.

Homer V. Flemming is named . . . manager of the Houston office of Ralph M. Parsons Co., engineers-constructors of Los Angeles. In this capacity Flemming will be responsible for business development in the petroleum, chemical, and petrochemical industries throughout the southwestern region. Before joining Parsons, Flemming was vice president in charge of sales for Refinery Engineering Co., Tulsa. He has over 25 years' experience in the petrochemical field.

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AERATE
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INJECT
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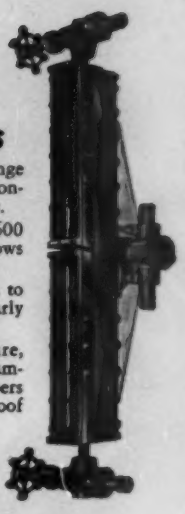
Direct Reading
LIQUID LEVEL GAGES

Designed with exclusive features for range of pressures, temperatures, corrosive conditions or other specific requirements.

- **REFLEX** — 3 pressure groups to 3600 psig. Lengths to 12 ft. Liquid shows black for positive accuracy.
- **TRANSPARENT** — 4 pressure groups to 10,000 psig. Lengths to 12 ft. Clearly shows color, density on media.
- **SPECIAL SERVICE** — High pressure, Frost-Proof, Heating Tube and Chamber, Welding Pad, Large Chambers and Inclined Gages, Explosion-Proof Illuminator.



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GAGE VALVES

Exclusive "floating shank" saves on installation, eliminates strains common to forced installations.

- Threaded Valves for service to 6000 PSI
- Threaded Valves for service to 1500 PSI
- Stuffing Box Valves for service to 750 PSI
- Special Valves and Accessories.

PENBERTHY
EJECTORS

Hydraulic, air and steam operated Penberthy ejectors (jet pumps, eductors, exhausters and syphons) simplify handling of fluids, vapors, gases and "hot" materials. In a variety of standard and special designs and materials.

PENBERTHY
SUMP PUMPS

Automatic, electric, explosion-proof, submersible and standard types in 8 models, 20 sizes.

Your request for literature or specific engineering data, for any or all Penberthy products, will receive prompt, personal attention.

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There's Certain Satisfaction in **PRODUCTS BY** PENBERTHY

- EJECTORS
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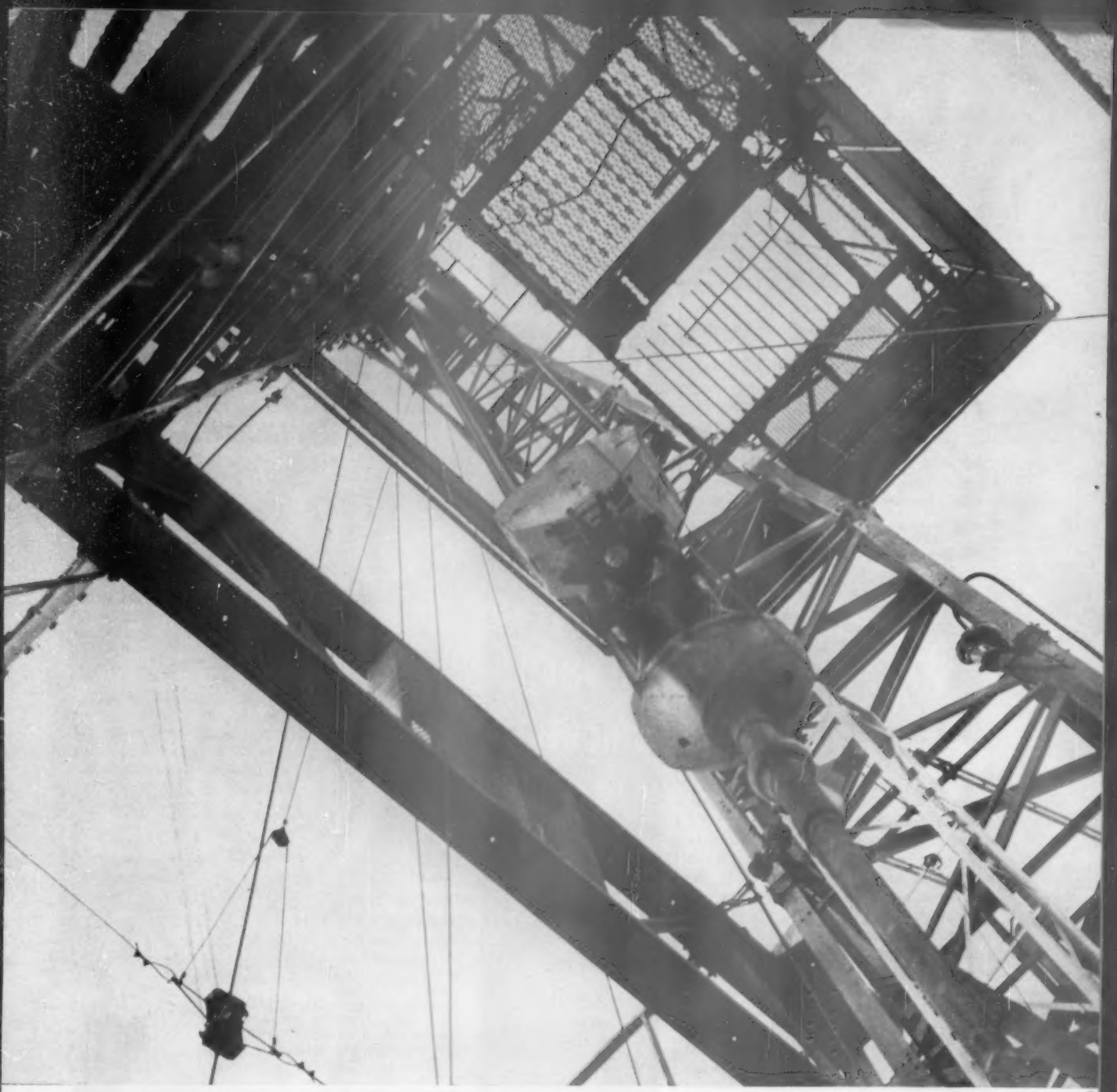


Bethlehem Rope Serves Louisiana Drill Barge. Here you are looking from the drill floor of the Two-R Drilling Co. barge in Barataria Bay, near New Orleans. It's State Unit No. 2, Well No. 1, being drilled for Texaco Inc. At the time of the photograph, the drilling depth was about 14,700 ft. The Bethlehem Wire Rope, 1⅜ in. 6 x 19 Formset Purple Strand, right lay, with IWRC, in service on its fifth well, was still in good condition, and showed a potential of many additional ton miles, due largely to a Bethlehem-recommended pull-through and cut-off program.

Bethlehem Steel Company, Bethlehem, Pa. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem Wire Rope

BETHLEHEM STEEL

Unusual tool string tames high-pressure Louisiana well

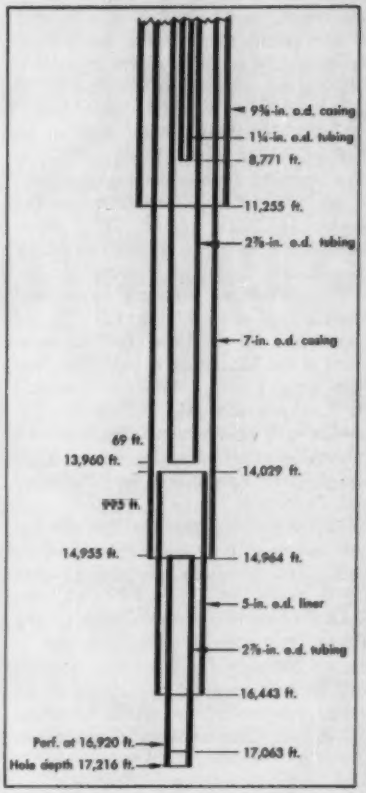
ONE OF THE WORLD'S highest-pressure wells, located in the Leleux area of Vermilion Parish, Louisiana, was completed with an unusual string of tubing and liner, by Union Texas Natural Gas Corp. (formerly Union Oil & Gas Corp. of Louisiana). The well has a shut-in surface pressure of 13,000 psi. with perforations at a depth of 16,920 ft.

Completion of the well required the resourcefulness of all concerned after a liner could not be set through the productive sand. Seven-inch o.d. casing was set to 14,964 ft., inside 9⅝-in. o.d. casing set at 11,255 ft. The 7-in. o.d. casing is cemented to the surface. After reaching a total depth of 17,216 ft., a 5-in. o.d. 18-lb. Extreme Line liner was run, but it stuck at 16,443 ft. and had to be cemented in place.

The cement was drilled out of the 5-in. liner using a bit on the bottom of a 2⅞-in. o.d. tubing string. The hole was washed on down to 17,063 ft. where it had been intended to set a 5-in. liner. The tubing was cemented at this depth with 65 sacks of cement. Enough cement remained in the bottom of the tubing, however, to prevent perforation at the desired level.

To solve this problem the 2⅞-in. o.d. tubing was backed off at 14,955 ft. with a string shot, and pulled out of the hole. A string of 1¼-in. o.d., 2.40-lb. tubing with a bit on the bottom was run back into the hole to drill out the remaining cement. This proved successful, enabling perforation at 16,920 ft.

To assure no further difficulty, Union ran National Supply Co.'s 2⅞-in. o.d., 7.90-lb., P-105 Spang plastic coated extreme line tubing. This tubing was packed off at 13,960 ft. inside the 7-in. o.d. casing just above the end of the 5-in. o.d. liner. Finally, a string of 1¼-in. o.d. tubing was hung in the 2⅞-in. at 8,771 ft. for use as a kill string and chemically treating the well.



THIS IS an unusual string of tubing and liner, used in a Louisiana well with a shut-in surface pressure of 13,000 psi., that solved a completion problem for Union Texas Natural Gas Corp. To assure trouble-free production, National Supply Co.'s Spang plastic coated tubing was run to 13,960 ft. and packed off inside 7-in. o.d. casing just above the end of 5-in. o.d. liner.

Montana firms join forces

IT HAS BEEN ANNOUNCED by Ike W. Taylor, president of Taylor Drilling Co., Lewiston, Mont., and L. P. Anderson, president of Great Northern Drilling Co., Inc., Billings, jointly announced today that their two companies have agreed to a plan of amalgamation. Under the terms of the amalgamation, effective immediately, Taylor will become chairman and a member of the board of directors of Great Northern. This company will acquire four rotary drilling

B and W Inc.
SCRATCHERS AND CENTRALIZERS
for a good cement job

B and W Latch-On Centralizer mounted over B and W Automatic Stop Collar

Gets casing to bottom
Prevents channeling
Centers casing positively

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rigs, rolling stock, and all other Taylor equipment. Commenting on this, W. J. (Poncho) Williams, vice president of operations, said, "Ike Taylor is one of the grand men of the oil-drilling business. All of us in Great Northern Drilling are proud and honored to be associated and working with him."

Great Northern, with offices in Billings, Miles City, Mont., and Denver, operates rotary drilling rigs and is an independent producer in the Rocky Mountain region. The amalgamation doubles its drilling capacity from four to eight rotary rigs.

This company recently completed negotiations with Union Oil Co. of California for a 1960 drilling program in the Mountain Front-Disturbed Belt area east of Glacier National Park. Anderson said, "This amalgamation will enable us to continue our expansion program and carry on regular drilling operations in Wyoming and Colorado.

Taylor Drilling was the first permanent rotary drilling contractor in Montana. The company has drilled over 1,300 wells in Texas, Illinois, the Rocky Mountains, and Canada. Ike Taylor has been actively engaged in the oil industry for over two decades and he was recently appointed as an industry representative to the Montana Oil & Gas Conservation Commission.

Old veteran retired

PERHAPS one of the oldest pieces of oil-field rolling stock has been retired and will be placed on the block. In 1922 Barnsdall Oil Co. bought a brand-new Mack truck for use on its leases near Fellows, Calif.

It was a beautiful new addition to the firm's equipment, complete with a shiny bulldog on its radiator and the original puncture-proof tires—the solid black rubber type.

In place of the usual array of instruments of present-day cars was an oil-pressure gage, an ammeter and a big brass plate which advised the driver "In order to obtain the most miles per gallon, the best power, the smallest repair bills, the truck driver must personally take an interest in keeping the motor at about 180° in all seasons of the year. The driver should get the motor temperature up to 180° as soon as possible by closing up the radiator. The choke should be used sparingly. Do not let the motor idle unnecessarily."

Other accessories of the truck include gas and spark levers on the steering wheel and 16 speeds forward. Sunray Mid-Continent Oil Co., successor to Barnsdall, will sell the veteran of 38 years to the highest bidder.

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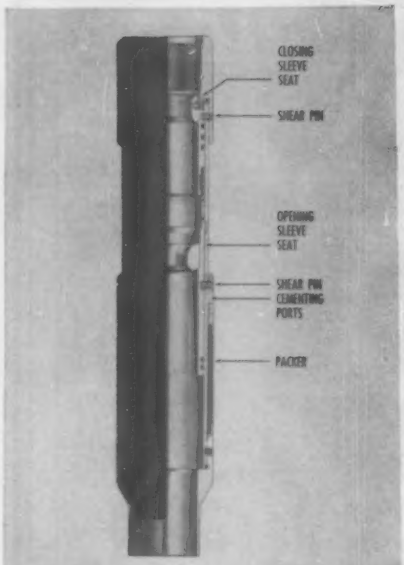

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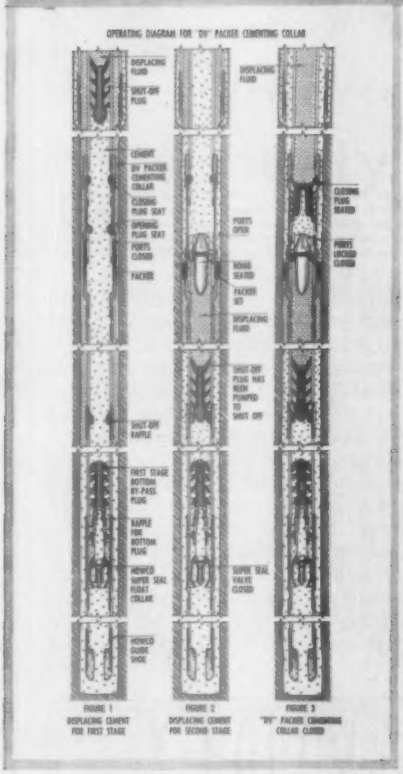

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- Where formation pressure of intermediate zone is greater than hydrostatic head of cement.
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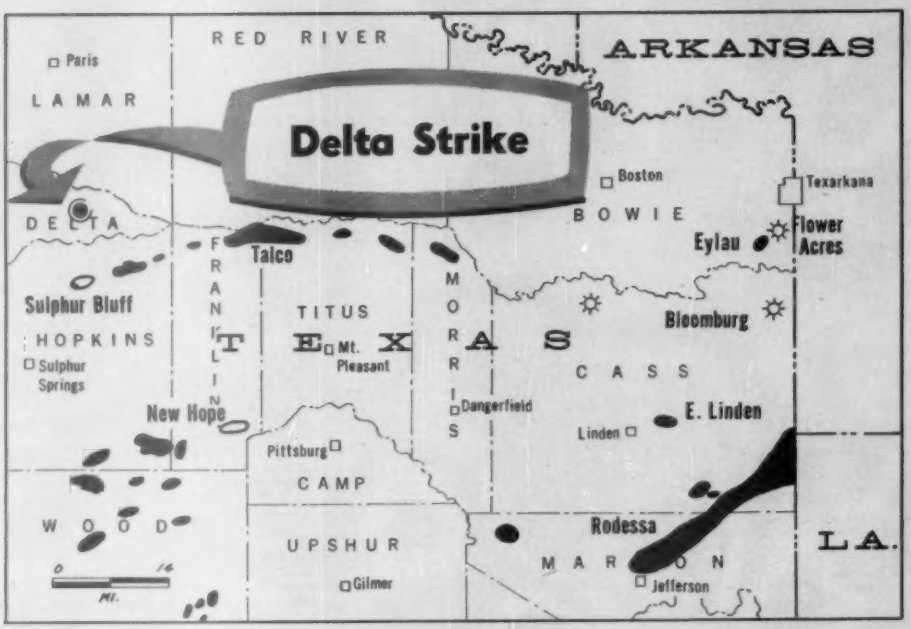


A NEW gas discovery in Delta County gives Texas its 211th productive county. Gibson & Best (formerly H. M. Naylor et al.) 2 Young found Smackover production at a much shallower level than previous finds in that formation.

New county on Texas producing roster

BY FRANK J. GARDNER

BIG TEXAS has a new producing county . . . its 211th. Bulletins from East Texas last week confirmed rumors of a significant new Smackover-Jurassic discovery in Delta County, 10 miles northeast of Cooper.

While some of the details about the discovery are still hazy, this one could well be the strike of the year for East Texas, if it's all it's cracked up to be. In the first place, of course, it opens a new county; secondly, it's producing sweet gas, unlike the other Smackover wells in this region; and third, it's the first deep pay northwest of the great Mexia-Talco fault zone that bisects East Texas.

A dry hole goes deeper . . . Drilling reports show H. M. Naylor as operator of the well, but investigation by Journal snoopers reveals that Naylor relinquished his interest in the 2 V. R. Young operation after the bit had reached Paluxy at 4,000 ft. without a payoff. At that point, R. L. Gibson and Walter C. Best assumed charge and sank the well to 7,100 ft. where the Smackover gas flow was found. Naylor had drilled three earlier failures in the vicinity; the first, 1 Young, was dry in Smackover, and the second and third went only to Paluxy-Lower Cretaceous, and were dry.

Located in the southwest corner of the John Haze Survey, the 2 Young was drilled by Gibson Drilling Co. of Kilgore, Tex. The operators hold a 32,000-acre block in the immediate vicinity. The discovery lies 10 miles north of the nearest Smackover well at Sulphur Bluff field in Hopkins County.

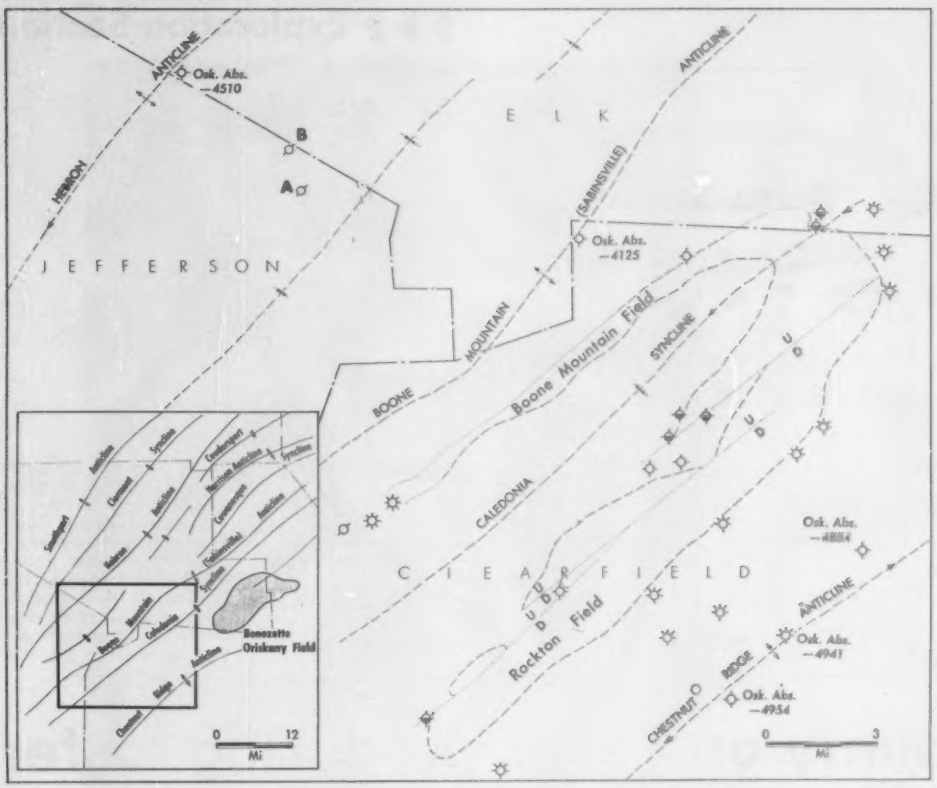
Operators are not releasing the footage on the perforated interval (said to be just below 6,900 ft.), nor the choke size on which a 5-million-cubic-foot gage was based; in addition to the gas, a 7-bbl. per M.M.c.f. flow of condensate was reported. A 32-ft. porous section near total depth is thought to be the source of production.

The only other fields located north of the main Mexia-Talco fault system in this vicinity lie in Red River County, northeast of the new well. One cluster of small fields in the northwestern part of the county produces from Paluxy at 1,600 to 2,400 ft., while one field in the southeastern part was a Glen Rose-Lower Cretaceous producer before its abandonment in 1954.

And opens new vistas . . . This is a highly faulted region, and solving the structural problems in future exploration will present many a headache. But if the Gibson & Best 2 Young is finished as a flush Smackover producer, East Texans will have a lot of new territory to cover in the search for new Cretaceous and Jurassic fields. Both gravity-meter and seismic surveys preceded the staking of the new discovery.

By curious coincidence, at the time of the announcement of success at the 2 Young in Delta County, the March issue of the Bulletin of the American Association of Petroleum Geologists appeared, with an excellent article entitled "The Mexia-Talco Fault Line in Hopkins and Delta Counties, Texas." It's authored by Dilworth S. Hager, Dallas geologist and producer, and Claude M. Burnett, geologist on Hager's staff. It's an exhaustive study of the area just to the south of the new strike, and could give perspective to those who anticipate future exploration in this region.

The lone Smackover well at Sulphur Bluff field was finished at 9,322 ft. in 1958. It gaged a potent 14,000 M.c.f. of sour gas daily, plus 1,050 bbl. of 64° condensate. The new Delta County discovery, with sweet gas at a much shallower depth, lends luster to the Smackover play, which already is aflame throughout East Texas.



A THICK deposit of Oriskany sand has been found in a syncline between two anticlines in Clearfield County, Pennsylvania.

Given little thought until a few months ago, now . . .

Oriskany found in Pennsylvania syncline

IS THERE ORISKANY GAS in a syncline? Perhaps Pennsylvania geologists gave the idea a quick thought, but until a few months ago, it's a good bet that none considered the idea too seriously, especially in applying the theory to North Central Pennsylvania where folding is pronounced. However, like many far-fetched ideas, this one has become a reality.

Fact-finding drilling. Drilling in northwestern Clearfield County has discovered two important facts which should become the basis for a new approach to Oriskany sandstone exploration. First, a thick accumulation of Oriskany sand has been found in a synclinal position between two anticlines which have no Oriskany sandstone, or at best a thin, impermeable veneer of this formation, on their crests. Second, commercial gas production has been developed from this synclinal accumulation of Oriskany sandstone.

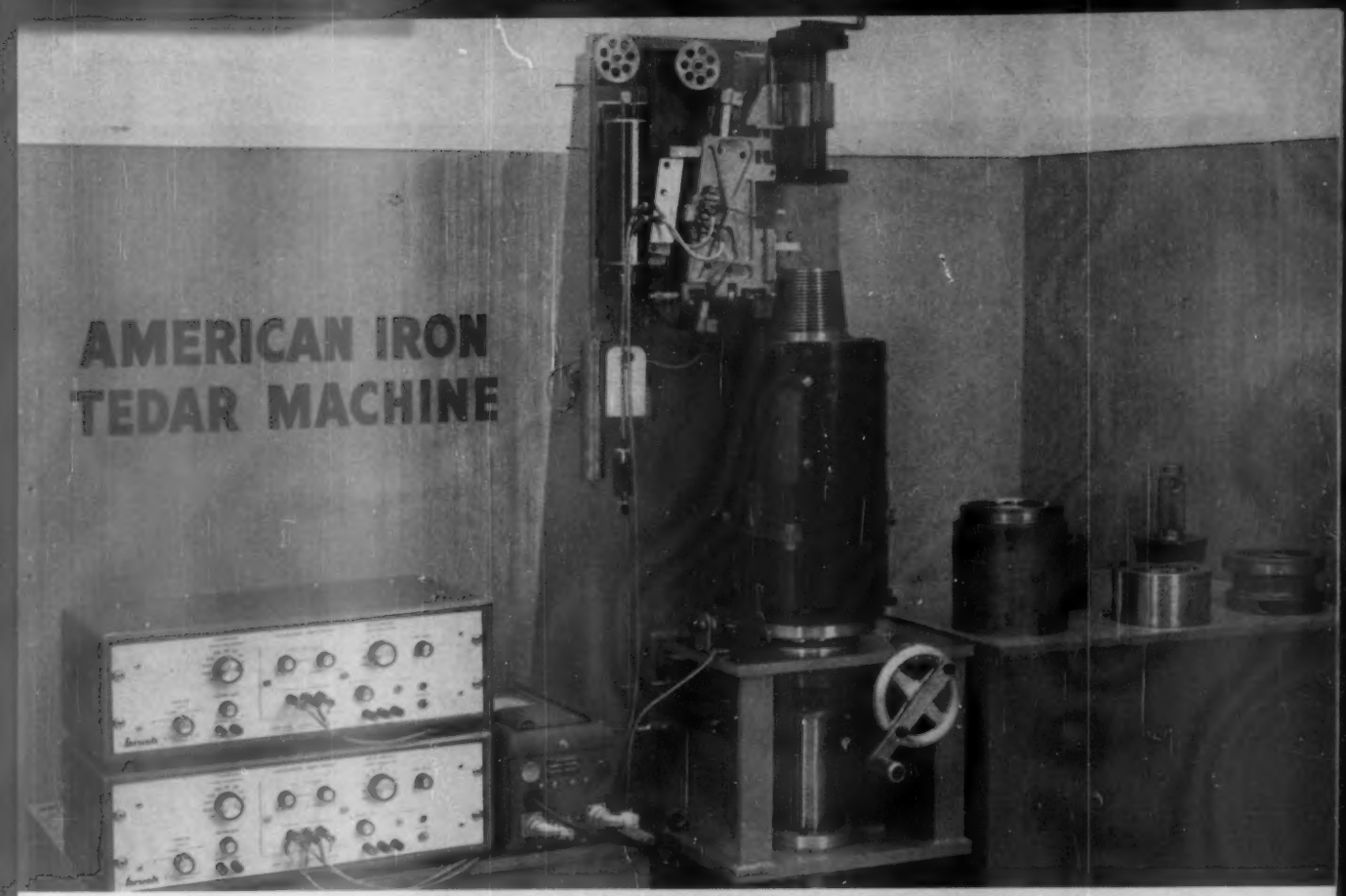
These discoveries will undoubtedly lead to exploration aimed at finding similar accumulations in a large area of North Central Pennsylvania in which it has been assumed that no Oriskany sandstone was present. This area includes everything shown on the accompanying map northwest of the Boone Mountain anticline. Five years ago the northwestern Clearfield County area was considered a part of this "no-sand" region.

Early drilling in Clearfield County was confined to the crest of the Chestnut Ridge anticline, finding the Oriskany either absent or thin.

BY CARL H. ROBERTS
Roberts & Hessin
Consulting Geologists
Coudersport, Pa.

History. Early drilling in Clearfield County was confined to the crest of the Chestnut Ridge anticline. These tests found the Oriskany sandstone to be either absent or thin and impermeable.

In the fall of 1954, Rockton Drilling Co. completed 1 Eva Moore as the first producer in Rockton field. This well, located near the southwestern end of the field, had only 8 ft. of Oriskany sand but was completed as a small producer after fracturing. Subsequently, wells lower on structure found greater thicknesses of Oriskany and an intensive development program resulted. The Oriskany sand thickness ranges from 14 ft. in the southwestern end of the field to



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"Early in 1960, interest in the Boone Mountain area was revived with the successful completion of a wildcat well 4 miles southwest of established production."

more than 30 ft. in the northeastern end.

Although the field is primarily a stratigraphic-type trap, several prominent, high-angle, reverse faults are present which separate the field into pools. Vertical displacement of the Oriskany on opposite sides of these faults is approximately 200 ft.

Downdip, the gas accumulation is in contact with salt water at an Oriskany subsea depth ranging from minus 5,700-50 ft. The updip limit of production is at an approximate structural depth of minus 5,300 ft.

Development of Rockton field is essentially completed. Through 1959, over 200 wells were drilled, at least 90% of which produced natural gas at depths ranging from 7,000-7,500 ft.

The open flows of the producing wells before fracturing generally ranged from 500 M.c.f.d. to 3,000 M.c.f.d Hydraulic fracturing caused increases of flows of 3 to 10 times the original. However, there were a number of large wells in the field with open flows ranging from 40 M.M.c.f.d. to 70 M.M.c.f.d. These larger wells were located on the upthrown sides of, and close to, the prominent faults. The high permeability of the Oriskany in and near these wells was undoubtedly due to fractures in the sand body.

In 1957, New York State Natural Gas Co. drilled a test near the crest of the Boone Mountain anticline. This test found the Oriskany sandstone absent and the well was completed as a shallow sand discovery.

Boone Mountain field. The same company then drilled on the southeast flank of the Boone Mountain structure and found 24 ft. of Oriskany sandstone with a show of gas. New York Natural's third well on State Tract 65, No. 1 was then drilled and completed as the discovery well of Boone Mountain Oriskany gas field. This well penetrated 30 ft. of Oriskany and had an initial open flow of 1,200 M.c.f.d. which increased to 6 M.M.c.f.d. after fracturing. Initial wellhead pressure was 3,900 psi. It is interesting to note that this well was 1,600 ft. lower structurally than the test near the crest of the anticline.

Subsequent development drilling extended the field northeast and southwest. The thickness of the Oriskany in the producing area is approximately 30 ft. However, the sand has had low porosity and permeability in the northeastern part of the field and initial flows were generally less than 2,500 M.c.f.d. Fracturing, as expected, increased the flows substantially, but production histories on most of the wells have been disappointing.

In 1959, production was extended around the rim of the southwesterly plunging Caledonia syncline and the Rockton and Boone Mountain fields were connected. Northeastward, production is limited in part by a permeability pinchout in the Oriskany. Of special interest is the presence of saltwater in the Oriskany along a segment of the northeastern production limit. This saltwater is higher structurally than production immediately southwest.

Effective closure in the northeastern part of Boone Mountain field, although variable, is approximately 150 ft., the gas accumulation being confined updip by a porosity and permeability pinchout in the Oriskany at a subsea depth of −5,600 ft. and downdip by the gas-water contact at −5,750 ft. The northwestern production limit of −5,600 has not been proved except in the northeastern portion of the field.

Bring new vigor. Early in 1960, interest in the Boone Mountain area was revived with the successful completion of a wildcat well 4 miles southwest of established production. This well, 5 Green Glen Corp., of a syndicate headed by the S. W. Jack Drilling Co., was completed with an initial open flow of 8,900 M.c.f.d. Two subsequent completions by this syndicate and one by Fairman Drilling Co. have further extended production 1½ miles southwest. The initial flows of these three wells have ranged from 7,750 M.c.f.d. to 15 M.M.c.f.d.

The largest of these wells is at a structural depth of slightly less than −5,600 ft. and probably indicates that, in this part of the field, the northwestern productive limit will be structurally higher than in the northeastern part of the field.

Further extension testing to the southwest is under way and area operators are optimistic about the possibilities of the field extending for many miles into Jefferson County.

Cledonia. The relation of the Oriskany sandstone occurence and gas accumulation to the Cledonia syncline has caused a revival of interest in the area designated as "Oriskany Probably Absent" on geological maps of Pennsylvania. The designation was based on the fact that the Oriskany was absent in the tests drilled in this area, the majority of which were located near the crests of the major anticlines which traverse the region in a northeast-southwest direction.

The first test of this area, an Alladin Petroleum wildcat, was completed as a dry hole. No Oriskany sandstone was present. Total depth was 7,139 ft. The absence of Oriskany will probably show up further exploration in the "no sand" designated area. More testing should come later, however. Alladin's plans for further testing of their large lease block are indefinite at present.

Remote wildcats probe deep in New Mexico's Guadalupe Mountains

NEW MEXICO'S Guadalupe Mountains near the southern border of the state that adjoins Texas are more and more coming into the exploratory picture west of the Permian basin.

There are three remote wildcats working in the area. All of them have had significant gas showings in the past week. Gulf Oil Corp. 1-AD Estel, 4 miles east of Carlsbad National Park, flowed 10 M.M.c.f.d. on 22/64-in. choke from Pennsylvanian perforations at 9,806-12 ft. Production is from Atoka. Location is 16 miles south of Carlsbad in NE NE 29-24s-26e, Eddy County.

To the west 22 miles Humble Oil & Refining Co. 4 Huapache Unit found some gas on a drill-stem test of the Pennsylvanian at 5,412-38 ft. Production here is in Bend Pennsylvanian. Location is in SW SW 14-24s-22e.

About 25 miles south of Humble's well, Mobil Oil Co. 1 State-Barnett found gas in a brown dolomite, presumed to be Pennsylvanian. This well flowed 1 M.M.c.f.d. on choke from 5,838-5,955 ft. Location is in Section 18, Block 63, T-2, T&P Survey, 10 miles south of the New Mexico border inside Texas' Culberson County.

Other New Mexico news. Continental Oil Co. 14-B Baish is a possible discovery in Pennsylvanian Strawn between 11,416 and 11,452 ft. This well, NE NW 22-17s-32e, inside shal-

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low Maljamar field and 3 miles south of the town, flowed 206 bbl. of oil in 3⅓ hours on a 4-hour test. There was also some free oil found in the Cisco at 10,660-10,743 ft.

In northern Lea County, Sun Oil Co. 1 M. J. McNulty found Pennsylvanian oil in the Bough "C" zone between 9,604-14 ft. This well flowed 192 bbl. of oil on 14-hour production test. Location is in SE SW 3-9s-34e, 7 miles northwest of Crossroads town and 4 miles southwest of Milnesand field in Roosevelt County.

Dual-zone extension announced for Louisiana

A dual-zone new-pay and extension discovery well on Block 20, South Pelto area, Louisiana offshore, has been announced by Murphy Corp., its offshore affiliate, Ocean Drilling & Exploration Co., and Burmah Oil Western Co., joint owners in the venture.

Initial test on the upper zone, with perforations at 10,890-93 ft. and 10,-896-10,901 ft., got a flow of 338 bbl. per day of 41.2°-gravity oil through 9/64-in. choke with gas-oil ratio of 1,627 cu. ft. per bbl. On the lower zone the initial test was at the rate of 2,016 M.c.f. of gas and 348 bbl. of 51.4°-gravity condensate daily through 10/64-in. choke. Perforations are from 11,069-75 ft.

This is the first discovery and the fourth well drilled by the Murphy-Odeco-Burmah group in Louisiana offshore waters where the three companies have undertaken a joint exploration program. The rig is being moved from the Block 20 well to adjacent Block 19 where an earlier dry hole had indicated oil shows.

The group has acquired 3,825 acres in Block 129A, Eugene Island area, on which there are six producing wells. An extensive 2-year program of development drilling and well workovers is planned for this tract, it has been stated.

Jud sand discovery finaled in North Texas area

New Jud sand production is reported in Haskell County, 10 miles northwest of Rule, Tex. The discovery well is Hayden Farmer 1 A. Hutchins in Subdivision 2, A. Slaydon Survey, A-58.

The well pumped 52 bbl. per day from open hole at 4,973 ft. to total depth at 4,981 ft. Location is about 1½ miles south of Jud W. Strawn and Conglomerate field. Top of the Strawn was 4,773-4,920 ft.; Jud at 4,972 ft.

These California sites provide news:

Deepening slated for Holtville wildcat

A wildcat drilled and suspended at 5,708 ft. more than a year ago near Holtville in Imperial County along the Mexican border was slated for a major deepening job.

H. W. Schafer was moving in a rig to take the remote wildcat on down to 8,500 ft. Landmen report the Imperial Valley has experienced a major lease boom in recent weeks despite the fact it is more than 200 miles from the nearest production.

Since the 1920s, oil companies, including a couple majors, have taken periodic shots at drilling in the lower reaches of California along the Mexican border without success thus far.

Northern California pool adds producer

Buttes Gas and Oil Co. gave the small Corning gas field in northern California's inland Tehama County a new shallow gas pool discovery. The new pay was tapped at 1,086-1,101 ft. and produced at a rate of 8 M.c.f.d. through a 1-in. choke on completion.

California's Vernalis extended

Standard Oil Co. of California successfully extended production in San Joaquin County's Vernalis field with a well ½ mile northeast of the nearest field producer. The new Standard well, 10 Blewett Community, was perforated in the Cretaceous between 3,010-75 ft. and brought in flowing 2,825 M.c.f.d. through 5/16-in. choke.

Deep test under way in Arbuckle gas field in California

A projected 12,000-ft. Sikes sand deep test in the center of the Arbuckle gas field producing area was spudded in recently. This deep Cretaceous test will probe for production 5,000 ft. deeper than the present gas horizons at around 7,000 ft.

Occidental Petroleum Corp. is drilling the wildcat on a farmout deal with Western Gulf Oil Co. in NE 4-13n-2w, in Colusa County. Based on seismic work, the operator expects to hit the Cretaceous Sikes sand between 10,500-12,000 ft. Occidental isn't discounting the possibility of encountering production between the present 7,000-ft. producing sands and the Sikes. Five additional deep test sites have been selected in the event the first turns up production.

Since last July when Occidental picked up 30,000 acres on a farmout from Western Gulf at Arbuckle, the company has run up a string of seven straight producers without a dry hole.

Most easterly North Tejon well completed

The steadily growing North Tejon field in Kern County counted its most easterly producer when Reserve Oil and Gas Co. completed a well in NE NE 20-11n-19w. The new well, which was taken to 14,528 ft. to look at a deeper zone, was plugged back and completed from the regular Z-1 zone at around 12,000 ft.

El Rio extended in California

Deep production in Ventura County's El Rio field was extended 2,000 ft. eastward by a well drilled in 22-2n-22w, by Standard Oil Co. of California, Western Operations, Inc. Standard found the pay in 109 net ft. of zone between 10,196-10,660 ft. Initial production was 348 bbl. daily of 26°-gravity crude through an 11/64-in. choke. It total-depthed at 11,546 ft.

First wildcat slated for remote California county

Largely mountainous Amador County in the heart of the old gold-rush country of Central California was slated for its first wildcat. The initial venture in the county will be drilled by Amador Exploration Co. in the southwest corner of the county about 40 miles southeast of Sacramento. Gas reserves will be the target of this shallow test. The nearest production is about 15 miles to the west in Lodi-Galt gas field of San Joaquin County.

Saticoy development continues in California

The record of good completions in the tricky Saticoy field of Ventura County was maintained by a recent completion of Shell Oil Co. on the northeast edge of the field. The Shell well goes a step further in practically connecting up the prolific Bridge Pool

activity in south Mountain field and Saticoy field. Both programs call for drilling wells under the Oakridge fault.

The newest Shell well, 40 SPS, was completed in selectively perforated Pliocene intervals between 8,372 ft. and 11,220 ft. Initial production was 490 bbl. daily, 16% cut, through a 32/64-in. choke.

One new oil pool in Illinois in March

A new oil pool, Highland in Madison County, was discovered in Illinois in March.

An extension was made to New Haven Consolidated oil pool in White County.

A total of 104 wells were completed in March, an average of 26 a week. The March completions include 42 oil wells, a success ratio of about 40%. In addition, three wells that had previously been completed as dry holes were worked over and recompleted as oil wells.

The total number of completions during the first 3 months of 1960 was 472, compared with 454 for the first 3 months in 1959. However, the success ratio declined from 51% for the first quarter of 1959 to 42% for the first quarter of 1960.

Estimated production for Illinois for March is 6,699,000 bbl. of oil.

More Abo reef oil for Southeast New Mexico

Eddy County, Southeast New Mexico, has another Abo reef discovery at Castle & Wigzell 1 Delhi-State, 33-17s-28e, 1 mile north of Empire-Abo field.

The Permian well flowed 96 bbl. of 45°-gravity oil daily on potential test through 10/64-in. choke from perforations at 5,890-5,930 ft. Top of reef was at 5,860 ft.

U. S. MULTIPLE COMPLETIONS MARCH 1960

	DUAL	TRIPLE
Arkansas	1	...
Kansas	2	...
Louisiana, North	1	...
Louisiana, South	18	1
Louisiana, Offshore*	6	2
New Mexico, West	4	
Oklahoma	20	1
Texas	56	1
District 2	9	...
District 3	8	...
District 4	4	1
East (5 & 6)	8	...
District 7-B	1	...
West (7-C & 8)	18	...
District 9	5	...
District 10	3	...
Total U. S.	108	5

*Has 1 quadruple well.

Oil action sets fast pace in N.W. Oklahoma

NORTHWESTERN OKLAHOMA continues to lead Mid-Continent oil and gas news. Counties figuring in current interest are Beaver, Blaine, Woodward, and Ellis.

Beaver. This Panhandle County has a two-zone discovery at Petroleum Inc. 1 Koch Unit in C NW SE 28-1n-25eCM. The Tonkawa and Morrow Pennsylvanian sands both produce.

From Tonkawa at 6,104-08 and 6,122-26 ft. the well flowed 101 bbl. of oil in 2½ hours, or 792 bbl. daily. Morrow at 8,141-47 and 8,222-26 ft. got 1,569 M.c.f.d. and 48 bbl. of oil.

The second test at Southeast Logan field, Apache Oil Corp. 1 Copple-Bell in C NE SW 9-1n-27eCM, flowed 1,400 M.c.f.d. during drill-stem test of Mississippian at 8,435-80 ft. The discovery well of the field in 17-1n-27eCM, a worked-over well, had Morrow production.

Blaine. Squaw Creek field will get its third well. Sunray Mid-Continent Oil Co. will drill 1 Baker-B in C SE NW 1-13n-13w, south of the discovery well. The second well in the pool, 31-14n-12w, was a Morrow producer. The discovery well and the new try will be Cherokee. Cherokee is expected at 10,770 ft.

Woodward. A new pool opened in this county at Shell Oil Co. 1-21 Blasdel-State in C SW NE 21-23n-22w. The discovery well is west of Woodward. Morrow perforations at 8,137-51 ft. yielded 1,926 M.c.f.d. on ½-in. choke and 24 bbl. of condensate.

Phillips Petroleum Co. will drill the fourth well at North Quinlan field in Woodward County. It will be the 1 Ball-B in C SW NE 13-24n-19w. The 1 Caldwell-F in C NE SW 18-24n-18w flowed 9,243 M.c.f.d. and 6 bbl. condensate in 5 hours from Chester Mississippian at 6,951-65 and 7,045-51 ft.

Ellis. A second dual completion for Gulf Oil Corp. at Luther Hill field is 1 State-Bob in C SW NE 16-24n-24w. Both Tonkawa and Morrow sands are producing. Morrow flow at 7,641-50 ft. was 2,570 M.c.f.d.; Tonkawa at 5,772-88 ft. made 5,200 M.c.f.d.

Mobil Oil Co. 1 Ruf in C SE NW 35-20n-26w, South Goodwin field, flowed 3,600 M.c.f.d. on tests from Morrow at 10,996 to 11,030 ft.

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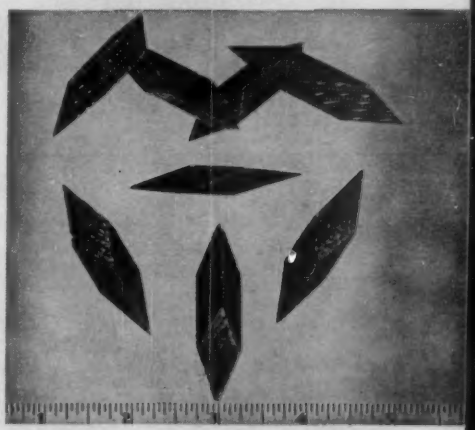

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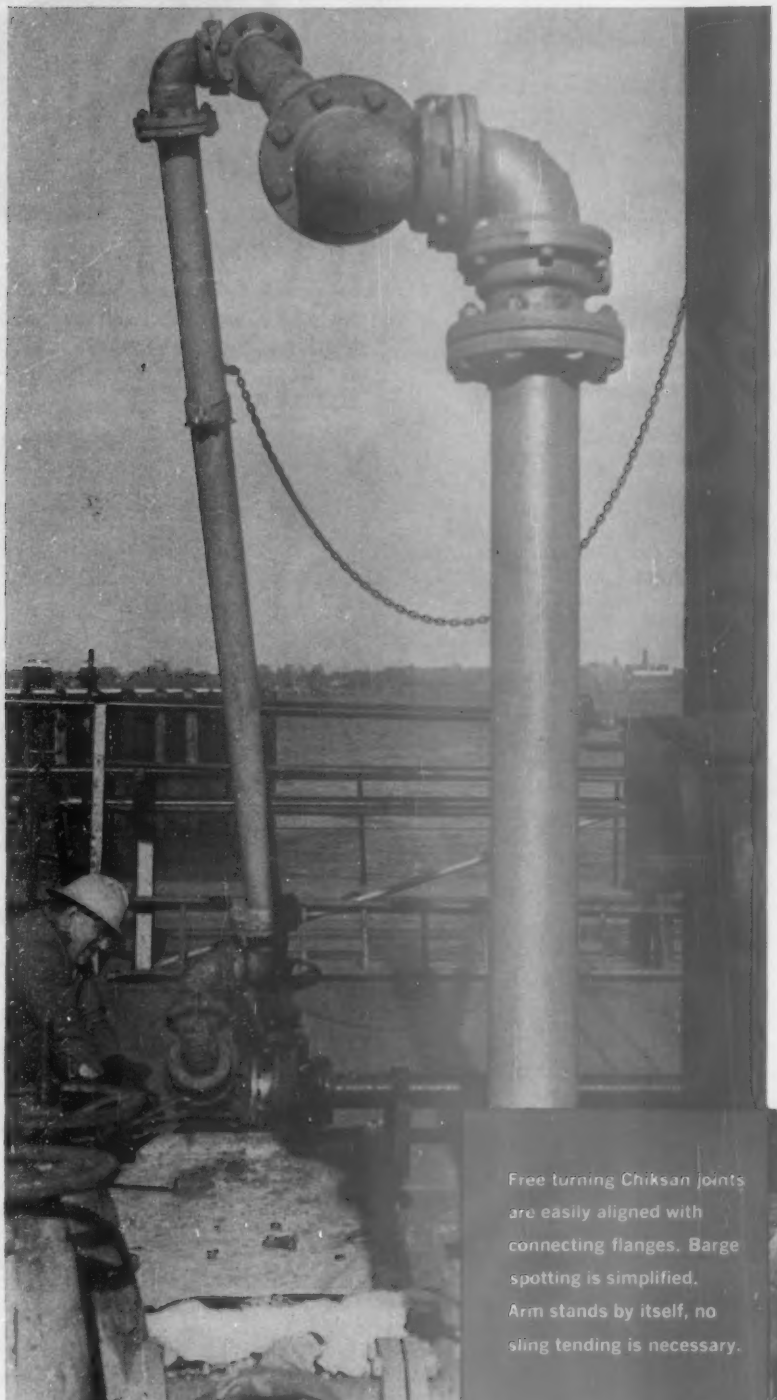

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New oil-hunting methods may boost Ohio production

FOR A CENTURY Ohio has been producing commercial quantities of oil and gas. Although the production has been moderate, over 650 M.M. bbl. of crude and 3 trillion cubic feet of gas have been produced. It is estimated that 150,000 have been drilled.

The discovery of oil and gas purely by accident in 1814 predates the Drake well in Pennsylvania by 45 years. In Noble County a well was being drilled for brine for the purpose of extracting salt when oil was encountered at 350 ft. The well flowed periodically and the oil was reportedly used for lighting and as a lubricant. This early discovery was considered a nuisance since the presence of oil rendered the brine useless for salt extraction.

During this long period the shallow formations have been well explored and in many areas overdrilled. The deeper rocks of the Cambrian and Lower Ordovician systems and the Middle Ordovician in Ohio have not been adequately tested. Approximately 300 wells have penetrated the Lower Ordovician and Cambrian systems. These older rocks could be holding vast quantities of oil and gas that might exceed the total production thus far yielded from the shallow formations.

At present the whole Appalachian basin, including Ohio on the western rim, is being studied and reevaluated by the major oil companies. Interest has been aroused by the discovery of oil and gas from the older formations in Ohio and neighboring states.

Two of the 13 tests drilled this year to the Lower Ordovician and Cambrian were successful. The 1-A Frank L. Smith, in Medina County, drilled by Wiser Oil, East Ohio, and Ohio Fuel Gas Co. was completed at 1,200 M.c.f. of gas and 5 bbl. of distillate daily after acidizing. The bottom-hole pressure was 2,435 lb.

Production is from the erosional surface in the Trempealeau. The producing depth was reported at 5,775-90 ft. Besides the 192 M.c.f. of natural gas at this depth, salt water and oil-cut mud were recovered from 5,856-65 ft. and 5,875-84 ft. The total depth of this well was 7,040 ft., bottoming in Precambrian metamorphics of Grenville age.

The second and most recent Cambrian well is the 2 N. J. Monk in Morrow County, drilled by N. J. Monk, et al. The well showed 4 bbl. of oil and 2 bbl. of water natural and was reported to have made 85 bbl. the first 11 hours after acidizing. After flowing intermittently for 45 days the well was pumped for 24 hours and made 95 bbl. of oil and 22 bbl. of water. Five pay zones were recorded at 3,594-3,602 feet, 3,621-30 ft., 3,685-89 ft., 3,710-14 ft., and 3,718-20 ft. Only the top two zones were perforated. Again the erosional surface on the Trempealeau is the producing horizon. The total depth of the well is 3,731 ft.

Of the 13 stratigraphic deep tests, four penetrated the Precambrian metamorphics. The previously mentioned Smith well in Medina County and the 1 Margaretha E. Warner also in Medina County, drilled by Ohio Fuel Gas Co., et al. were drilled to a depth of 6,731 ft. The Warner was a dry hole. Kewanee Oil Co. drilled the other two unsuccessful basement tests. The 1-A Harry Long in Pickaway County bottomed at 3,257 ft. and the 1 Van Pelt in Clinton County had a total depth of 3,259 ft.

The other nine tests penetrated the

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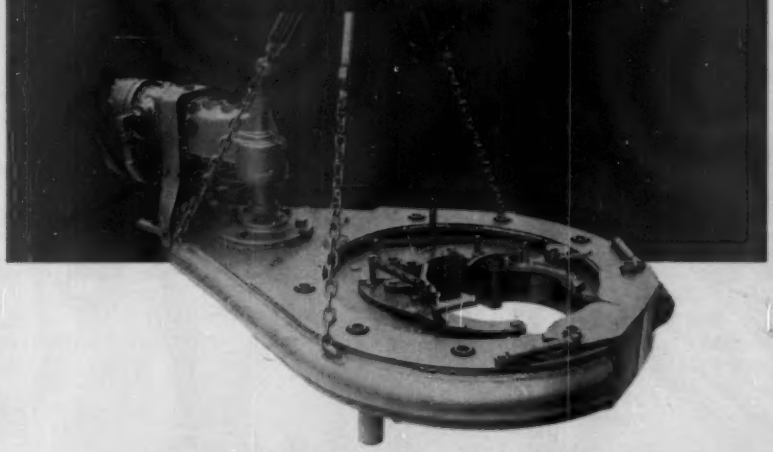

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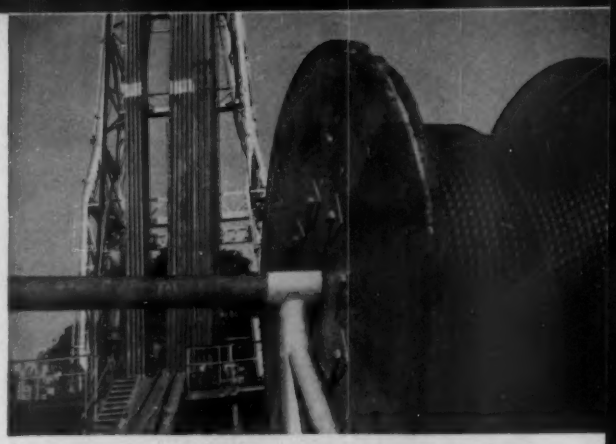

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Lower Ordovician or Cambrian, the previously mentioned 1 Monk being the only one of this group successfully completed in the older sediments. Two wells in Ashtabula County, Russel McConnell's 1 C. M. Brydle total depth 5,710 ft., and Devonian Gas & Oil Co.'s 1 Conrad Mueller, total depth 6,238 ft., were drilled to the Trempealeau. Both of these were plugged back and completed as gas wells in the Clinton sand.

Kewanee drilled two holes to the Mt. Simon sandstone. The 1 Harold & Faye Pavey, in Highland County, had a total depth of 3,512 ft. and the 1 Newton and Ledia Igo, in Clinton County, bottomed at 3,351 ft. In Medina County, Wiser Oil Co.'s et al. 3-A Hayden H. Heir was drilled to 6,031 ft. testing the Trempealeau. S. E. Brown et al.'s 1 H. & A. Gecowets, in Defiance County, bottomed at 2,300 ft. in the Trempealeau. The Glenn R. Nye, et al. 1 Harry Johnson, in Coshocton County, bottomed at 5,845 ft. in the Trempealeau. The Continental Oil Co., a newcomer to Ohio, drilled the 1 Walter C. Brisbin to 2,715 ft. in Hamilton County, stopping in the Eau Claire dolomite.

The Trenton tests numbered 21, of which 11 were wildcat wells. Six of the Trenton wells were completed as small oil or gas wells. Three wells in Defiance County were completed at 2 to 10 bbl. daily. The others were small gas wells which were sold to the land owners.

McClure Oil Co. drilled two wells in Fulton County and one in Williams County into the Trenton-Black River section in hopes of extending the significant Trenton fields of southeastern Michigan. Small shows of oil were noted in the Trenton in one of the Fulton County wells and the Williams County well. All three were abandoned.

Another interesting wildcat was the 1 Warren F. Shank drilled by Ohio Drillers in Crawford County. The total depth was 2,160 ft. and no shows were noted in the Trenton.

The Clinton sands of the Medina group account for over half of the wells drilled. A total of 672 wells were drilled, of which 162 were gas, 88 were oil and 296 were combination oil and gas producers. The 126 dry holes give a percentage of 18.8% failures. The 81.2% successful completions look good in the beginning; however in light of the poor marketing situation and the ever-increasing prices of material and labor, it is questionable whether half of these wells will pay out. Also a plague to the industry and a waste to the operator and investor is the lack of well

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spacing. Year after year large initials are reported yet many of these wells fail to make money.

The most active county was Wayne County, where 127 Clinton wells were drilled. Of the 95 producers, 22 were gas, 8 were oil and 65 were combination wells. Holmes, Coshocton, and Perry counties each had over 70 Clinton wells drilled within their boundries. More than 45 Clinton wells were drilled in each of the following counties: Knox, Licking, and Muskingum.

The largest gas well reported was Felmont Oil Corp.'s well, 1 Walter Hall in Monroe Township, Ashtabula County. The natural open flow was 1,500 M.c.f. of gas from interbedded shales and sands of the Clinton from 3,034-3,133 ft. The production after fracture was reported at 20 M.M.c.f. of gas and the 16-hour rock pressure was 1,020 lb.

"Year after year large initials are reported, yet many of these wells fail to make money."

Vinton County had a Clinton completion reported at 16,030 M.c.f. of gas after fracture. This was Darrell Blanton's well, 1 Pearl Bray, located in Swan Township. The sands ranged from 2,814-51 ft. The natural production was 1,280 M.c.f. of gas. The 48-hour pressure was 832 lb.

Perry County, one of the more active counties for several years, had a sizable gas well reported. Hoosier Drilling Co.'s well, 1 William McClond in Madison Township, was completed after fracture at 10,450 M.c.f. of gas. The Clinton sand ranged from 3,214-46 ft. which was the total depth. The natural gage was 340 M.c.f. of gas.

Three Clinton oil wells were reported completed at 500 bbl. or more after fracture. The Alkire, Floto, et al.'s well, 2 Parker Rine, in Knox County, Jackson Township, made 18 bbl. natural and was reported completed after fracture at 600 bbl. of oil. The Clinton sand and shales ranged from 2,932-84 ft. R. B. Weed & Associates' well 7 Muskingum Watershed Conservancy District located in Coshocton County, New Castle Township, was completed after fracture at 500 bbl. of oil and 750 M.c.f. of gas. The interbedded Clinton sands and shales ranged from 2,873-2,933 ft. R. S. King's well, 1 Snyder in Wayne County, Canaan Township, was completed after fracture at 500 bbl. of oil and 500 M.c.f. of gas. The interbedded Clinton sands and shales ranged from 2,965-3,100 ft.

The "Newburg" horizon received some attention this year as a result of the deeper Clinton play in Wayne County. This dolomite pay is an erosional zone, occasionally some reefing has been found at the base of the Cayuga group and in the top of the Niagara group. Of the 16 wells drilled in Wayne County, 13 were completed as gas wells. Production ranged from a few hundred thousand to 11 M.M.c.f. of gas. The largest of these wells was Preston Oil Co.'s 7 R. J. Dial located in Franklin Township. The dolomite pay was recorded at 2,988-3,056 ft. The production after acidizing was 11,400 M.c.f. of gas. The 24-hour rock pressure was 1,140 lb.

The only significant Oriskany sand well was the Ohio Fuel Gas Co.'s well, 1 Harrold W. Gerber in Wayne County, Sugar Creek Township. The Oriskany sand was found at 2,579 ft. and the total depth was 2,580 ft. The well was completed natural at 40 bbl. per day. An offset to the west of this well proved dry.

The first and second Berea again hold the second and third position

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in the number of completions this year. The first Berea had a total of 251 wells of which 58 were gas, 90 were oil, and 21 were combination oil and gas wells. The second Berea had a total of 49 wells of which 27 were gas, 4 were oil, and 8 were combination wells. The initial production from these zones is seldom greater than 20 bbl. of oil and 500 M.c.f. of gas.

The shallow sands of upper Mississippian and Pennsylvanian in eastern Ohio account for about 10% of the annual total wells drilled. A total of 118 wells were drilled, 56 of these were producers. Production from these shallow wells is small and of little significance to the total production.

A total of 1,158 wells were drilled in the state this year. Of the total, 843 were producing wells, 305 were gas, 203 were oil, and 335 were combination of oil and gas wells. The dry-hole percentage was 27.2%. The first 24-hour daily initial was reported to be 30,504 bbl. of oil and 434,337 M.c.f. of gas. The total footage drilled was 2,845,373 ft. for an average of 2,457 ft. per well.

The actual production of oil for the year was 5,978,280 bbl., down approximately 500,000 bbl. from the 1958 production. Gas production increased approximately two and one half billion cubic feet. The total gas produced was 36,311 M.M.c.f. The estimated value of the production at the wellhead is $26,242,068.00. The value of the oil produced was $17,174,007 and gas was $8,460,463.

The estimated number of producing wells including this year's wells and those still producing from prior years is 24,054. Of these, 7,120 are gas and 16,934 are oil.

The Future

Two discoveries in the sediments of the upper Cambrian have aroused increased interest in the deeper horizons. It is anticipated that an increasing number of wells will be drilled to test the lower Ordivician and Cambrian sediments. A reevaluation of the Appalachian basin by the major companies is now in progress. It is hoped that a study of the limited data available will disclose some information as to what may be expected in these older sediments. The high arch area of western Ohio which has been more or less dormant for 50 years will again be subjected to testing. From this area the testing will probably spread eastward into the Appalachian basin.

The Clinton drilling will continue to be active. However, this picture could be much brighter if spacing, completion, and production practices were improved. East Central and Northeastern Ohio will be the more active areas.

It is hoped that more and better geological and engineering methods will be applied to the petroleum industry in Ohio. All available data should be preserved and used by the operators as a means to reduce expenses.

—George G. Shearrow
Ohio Geological Survey
Columbus, Ohio

Deep test begins in Medina, Ohio

IN HINCKLEY Township, Medina County, Ohio, Ohio Fuel Gas Co., East Ohio Gas Co., and Wiser Oil Co. have started drilling operations to offset their successful Cambro-Ordovician gas producer, 1A F. Smith, Lot 69. (O&GJ Feb. 16, 1959).

Location of 2 L. Divoky, Lot 52, is about 1,400 ft. north of the producer and will be drilled with cable tools.

This will be the fourth test of these sediments in the general area.

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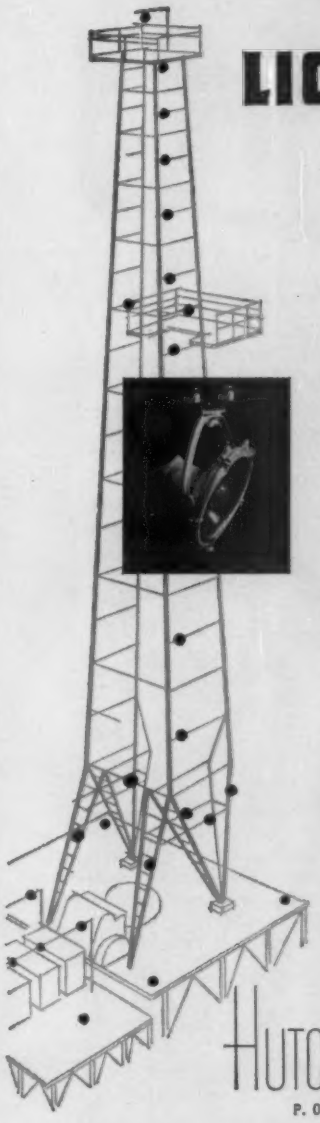

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Permian gas extension reported in Panhandle

Council Grove Permian gas production was extended in Oklahoma Panhandle's Beaver County at Anabaco Operating Co. 1 Rose Smith in SW NE 33-5n-26eCM.

The well flowed 1,050 M.c.f.d. on drill-stem test at 3,360-3,400 ft., extending Mocane gas area Council Grove production 2 miles south. Location is 3 miles southwest of Knowles.

Cherry Canyon discovery finaled in Ward, Texas

Ward County in West Texas has new Cherry Canyon production at Norwood Oil Co. and Amarillo Oil Co.'s 1 Anna Herring in Section 94, Block 34, H&TC Survey, 8 miles northwest of Spencer field and 6 miles south of Pyote.

The well flowed 193 bbl. of 39.2°-gravity oil daily on potential test through 22/64-in. choke. Perforations are at 6,109-17 and 6,129-34 ft. Delaware sand top was 5,096 ft., Cherry Canyon Permian at 5,860 ft.

Minnelusa tapped by Wyoming well

MINNELUSA Pennsylvanian oil production is assured at a Campbell County wildcat in Powder River basin, northeastern Wyoming.

The discovery well is Kewanee Oil Co. 1 Norman in NE NW 14-48n-69w. Swab got 20 bbl. of oil hourly on tests. Operator has installed pump and shut down for storage.

Production at this new Pennsylvanian pool opener in the Powder River basin is from perforations at 8,338-65 ft. Location is 2 miles southwest of Dakota Cretaceous production in Raven Creek field. Closest Pennsylvanian production lies 6 miles northeast at Donkey Creek field. There has been considerable drilling in the immediate area, but none went to Pennsylvanian. Minnelusa discoveries have been made of late about 12 miles northwest of the new strike.

Abstract

COYOTE CREEK FIELD—ITS CHARACTER AND SIGNIFICANCE, by John F. Trotter, Mobil Oil Co.

Coyote Creek field is the largest Dakota stratigraphic trap so far discovered on the eastern flank of Powder River basin. The trap is formed by

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an updip change from clean sand to impermeable sand, siltstone, and shale in an area of homoclinal dip.

The sand body appears to be a near-shore marine deposit and has excellent reservoir characteristics. Forty-eight producing wells and eight dry holes have been drilled. Development continues.

Coyote Creek was discovered between two dry holes 1¾ miles apart. The field is significant because its study demonstrates stratigraphic principles which may be used in searching for new oil fields.

Abstract of a paper presented at the Billings, Mont., meeting of the Rocky Mountain section, AAPG, February 1960.

Matagorda gets new Texas field discovery

A new field discovery for the Texas Gulf Coast has been made in Matagorda County by M.P.S. Production Co. and Houston independent oil operators Van Dyke & Mejlaender.

Their 1 George Krueger, drilled to 6,811 ft., had a calculated open-flow potential of 11,500 M.c.f.d. of gas with 1.2 bbl. of distillate per M.M.c.f. Perforations were in the top of the Frio at 6,722-26 ft. Shut-in tubing pressure was 2,450 psi.

The well is 6 miles north of Bay City on a 367.2-acre lease in the A. W. Mangum Survey A-362. It is midway between North Bay City and Armour fields. Operators have approximately 3,800 acres in their block. They have asked that the new field be named West Chalmers.

Several sands in the discovery well appear to be commercially productive. The well is a south offset to operators' 1 Pierce Estate, which still is being tested for dual completion.

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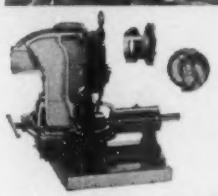

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Prolific gas well reported in Stephens County, Texas

A Big Saline gas discovery in east-central Stephens County, Texas, flowed 35 M.M.c.f.d. from perforations at 3,752-67 ft. It is Pan American Petroleum Corp. 1 A. B. Lane, 5 miles northwest of Brad in Section 14, Block 4, T&P Survey, 1¾ miles east of Pharris Marble Falls field.

Driller completes Kentucky well to tap Corniferous

In Highland pool of western Breathitt County, Preston Oil Co. has completed 1,580 gross for an 80-bbl. oil well. Producing horizon is Corniferous lime topped at 1,312 ft. and penetrated to 1,363 ft. total depth. Test lies in the southwest sector of the Jackson Quadrangle.

Big well completed in Wyoming's Big Piney

A Big Piney field well, Gulf Oil Corp. 19 Tresner-State, SE SW 36-29n-113w, Sublette County, completed flowing 2,065 bbl. of oil per day through ½-in. choke. Production is from Mesaverde Cretaceous at 3,118 ft.

Old Ellenburger well becomes Fusselman hit

Reentry into an old Ellenburger well in Reagan County, 3 miles east of Stiles, Tex., resulted in a small Fusselman discovery. It is Cabot Carbon Co. 1 Zulette Hughes in Section 5, Block L, TCRR Survey, 1¾ miles northeast of Stiles field.

The new-pay discovery is flowing 26 bbl. of oil daily on 26/64-in. choke from perforations at 10,282-87 ft. The original well, completed last summer, flowed 183 bbl. of oil daily on 23/64-in. choke from Ellenburger below 10,370 ft. Both pays have 59°-gravity oil.

Michigan oil lucrative, but hard to find

MICHIGAN has substantial untapped oil deposits.

"This seems to be the general opinion of many geologists who have made extensive studies of what is referred to geologically as the Michigan basin," according to Dr. William J. Hinze, assistant professor of geology at Michigan State University.

But Michigan is prevented from realizing its full potential as a producer of oil by obstacles that hinder the petroleum explorer in locating oil fields. Chiefly responsible are the types of subsurface structures, the great depths of producing horizons, and the glacial drift covering the basin in depths of up to 1,000 ft.

MICHIGAN STATE UNIVERSITY graduate students, Don Merritt, left, and George Secor run checks on equipment to be used in the first phases of a complete magnetic map project to start this summer in the state's Upper Peninsula.

Need geophysics. Dr. Hinze, who is in the process of developing a strong geophysical program within the MSU geology department, believes that much can be done to solve some of the state's petroleum exploration problems. With the help of other geologists and graduate students in his department, he has laid out a long-range program of research that promises to provide much valuable information for future oil exploration.

Among the several important facets of this proposed program is a field study leading to a complete magnetic map of Michigan and adjoining areas. Preliminary studies indicate that this information will be valuable both for petroleum and mineral exploration when tied to other geophysical and geological data. A part of the study will be carried out this summer when a graduate student and his wife, Mr. and Mrs. George Secor, East Lansing, will make magnetic and gravity measurements in three counties at the west end of the upper peninsula, Gogebic, Ontonagon, and Iron.

Rocky study. Among other aspects of the extensive research program is a physical property study of the rocks of the Michigan basin. Of special significance will be densities of outcropping layers of rocks, densities of well cuttings, and the effects of geological structures on rock densities. Knowledge of preglacial drainage patterns studied by geophysical techniques also will be used as a possible aid in locating significant structures in the basin that may indicate oil deposits. These preglacial drainage patterns also will be helpful in the search for ground-water reservoirs, it was explained.

Still another phase of the research program will involve an investigation of the possible relationship between bedrock seismic velocities and fracture zones that are known to act as petroleum reservoirs.

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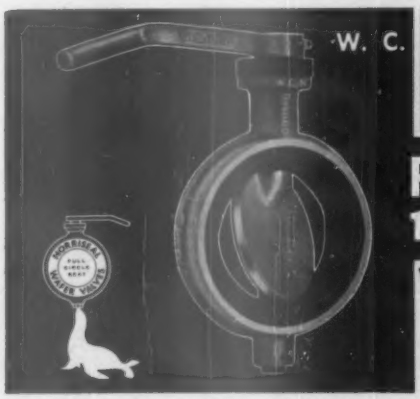
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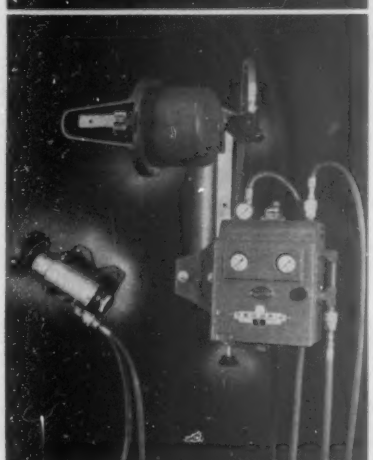

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this program be highly valuable as training and experience for our geology graduate students, but we expect to make valuable contributions to the already existing knowledge in the petroleum-exploration field," Dr. Hinze explained. "We hope to increase the effectiveness of currently applied geophysical methods of exploration and in particular develop new methods specially adapted to the Michigan basin.

"New methods of exploration may come from the application of entirely new methods, revision in present methods, and new correlations between geological features and the occurrence of petroleum."

Lack of some essential equipment is the big obstacle confronting the geology department at present. To date several oil companies have generously donated some expensive units, but others not available through departmental budgeted funds will be needed before the project can go far.

Dr. Hinze said that the aim of the department is to develop its geophysical section to a facility that will be a rich training ground for prospective petroleum geologists and geophysicists and at the same time make substantial contributions to the development of Michigan as an oil state.

Good Dakota production at Denver basin well

Vallery field in Morgan County, northeastern Colorado, picked up a good producer last week at Gold Coin Mining & Leasing Co.-Inland Drilling Co. 2 Weimer in C NE SW 15-3n-59w.

The Denver basin well flowed 300 bbl. per day on ⅜-in. choke from "J" sand perforations at 6,022-26 ft. This is the first such producer in the "D" sand oil and gas field. There is some "J" sand gas production.

Yuma County. An apparent Yuma County discovery, S. D. Johnson et al. 1 State in SW SW 16-2n-42w, 18 miles northeast of old Beecher Island field and 40 miles east of Hyde field, pumped oil at the daily rate of 11 bbl. from Lansing-Kansas City Pennsylvanian at 4,721-23 ft. This wildcat could open first production in this section of Colorado which lies on the western flank of the Las Animas arch and in remote sections of the Denver basin's eastern flank.

Nebraska. Russel field in Kimball County gained a good offset discovery. It is Braden Drilling Co. 4 Peterson in C SE NE 14-16n-58w. The well pumped 360 bbl. of oil daily from "J" sand at 7,040 ft. in a casing notch. It is the south offset to two "J" sand wells in the field.

Newest Green River find in Sweetwater County

Newest gas discovery in Green River basin is Continental Oil Co.'s 5-2 Sand Butte in C NW NE 5-17n-99w, Sweetwater County, Wyoming.

This discovery well of Sand Butte Unit gas field had a calculated open-flow potential of 10,624 M.c.f.d. from Almond Cretaceous perforations at 4,616-4,830 ft. Location is 5 miles southwest of Patrick Draw Almond field and 3 miles northeast of the first Sand Butte well which was dry at 6,595 ft. There has been no drilling between the new producer and Patrick Draw, opening a vast area for future prospecting in Green River's speeding gas play.

Second Louisiana well deeper than discovery

Second well at South Creole in southern Cameron Parish, southwestern Louisiana, is completed in a sand nearly 1,800 ft. deeper than that in the discovery well.

The new well, confirming discovery of production in the area, is productive of gas and condensate from perforations at 12,906-89 ft. Pay in the discovery well is at 11,100 ft.

Sunray Mid-Continent Oil Co. drilled the new well, its 1 Rutherford, to 14,635 ft. before backing up to the 12,900-ft. pay. Gas flow was not gaged, but liquid (48°-gravity condensate) recovery 7 bbl. with a gas-liquid ratio of 271,420 cu. ft. per bbl.

Location is ½ mile south of the field's discovery well, drilled by George R. Brown and completed in March 1959 good for 3,411 M.c.f. of gas and 76 bbl. of 50.8°-gravity condensate daily. The field is just inshore from the coastline. It is 2 miles southwest of West Chenier Perdue field.

Galveston Bay field continues to grow

The new South Redfish Reef field, off the south side of the original Redfish Reef field, in Galveston Bay, Texas Coast, continues to spread, both in area and productive importance.

Its fourth well is being completed as a good oil well in Frio sand at 11,458-64 ft. Flow through ¼-in. choke was gaged at 105 bbl. per day. Oil-gravity is 49.8°.

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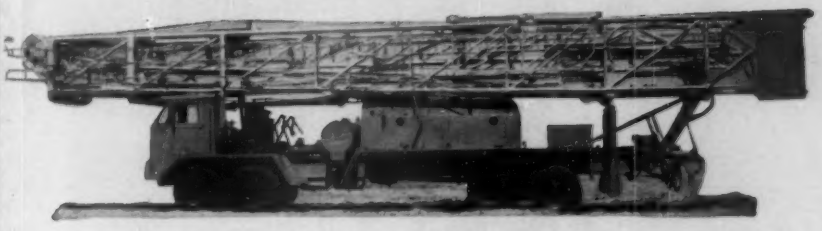

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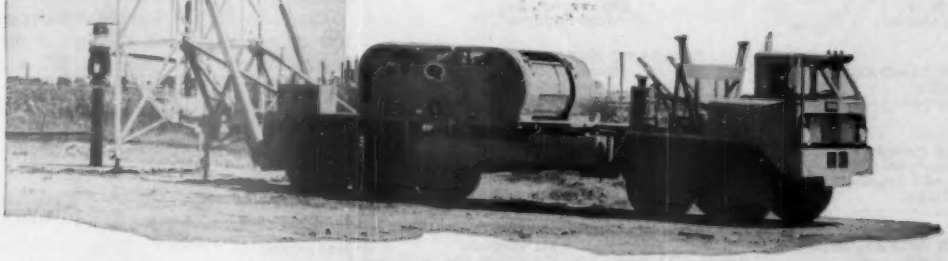

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tor in the original field, also has this area, most of it on the Galveston county side of the line dividing the bay. The fourth well, 101-A, in Tract 285, is 2,200 ft. northwest of Humble's 95-A oil-discovery well.

Texas Gulf Coast well is confirmed

An oil discovery late last year by Standard Oil Co. of Texas in the Gulf of Mexico off the Texas Coast has been confirmed by completion of the company's second well in the same block.

The new well, 2-A Federal 58 SW, in Block 52, is only 3,498 ft. north of the initial well. The latter was the only discovery of the year in Texas' offshore waters. Both wells are productive from an 8,500-ft. sand. The first is perforated at 8,562-57 ft., and the second at 8,520-26 ft.

Flow of 206 bbl. of 35.5°-gravity oil per day through 8/64-in. choke was recorded by the second well. This compares with a flow of 228 bbl. daily through 10/64-in. choke in the first well.

The new field is 39 miles northeast of Galveston, and about 12 miles offshore. Nearest production is 12 miles northeast in High Island Block 10-L field.

Major stepout completed in Texas' Zapata

A major confirmatory stepout gas well has been completed by Crescent Petroleum Corp. in the northeastern Lopeno area of Zapata County, in far South Texas. It is 2½ miles northeast of another discovery well brought in by the same company earlier this year.

Both wells are on a 50,000-acre block stretching from Zapata County into adjoining Starr County, on the east.

The new well, 1 Serapio Vela, has 200 ft. of gross sand section in the Lower Wilcox formation. It is open through casing-perforations at 11,054-64 ft., 11,136-50 ft., and 11,192-11,208 ft. On test through 1.8-in. choke, the well flowed 1,9 M.M.c.f.d. of gas with 5,000 psi.

Crescent's initial well, 1 Foss, is productive from Upper Wilcox sand, perforated at 7,796-7,802 ft. It tested 1,500 M.c.f.d. of gas through 3/16-in. choke.

Both wells are on a developing trend of new-field and extension discoveries in deep Wilcox sands extending northeastward on the eastern side of Zapata County from the original Lopeno field, in the south corner of the county, near the Mexican border.

New gas-condensate find for Texas' Rio Grande

Deeper exploratory drilling off the southeast side of Barrosa field in eastern Starr County, in Texas' Rio Grande Valley, has resulted in new Vicksburg gas-condensate discovery.

It is by Monsanto Chemical Co. at its 1 Davenport, in Section 532, G. Jiminez Survey. In prepotential tests, the well flowed 2,780 M.c.f. of gas and 58 bbl. of 60.2°-gravity condensate per day through ¼-in. choke with pressure of 1,753 psi.

Pay is perforated at 7,625-50 ft. This is the shallowest of a series of potentially productive zones logged and tested in drilling to total depth of 9,514 ft.

Completion follows a long fishing job to recover drill pipe stuck when the well kicked heavily and tried to blow out while drilling.

The area is 20 miles northeast of Rio Grande City. Barrosa field, discovered in 1948, is productive of oil and gas from Frio sands at depths of 4,100-4,500 ft. It has eight oil and two gas wells.

DeWitt County, Texas wildcat completed

A wildcat test more than a mile west of Barry field, in southeastern DeWitt County, central coastal area of Texas, is being completed as an oil discovery in Yegua sand after failing in the deeper Wilcox.

It has been plugged back from its total depth of 8,018 ft. and perforated at 4,984-89 ft. Flowing through ⅞-in. choke, it made 58 bbl. of 46°-gravity oil in 24 hours. There was no water. Flowing pressure was 1,120 psi.

The well, drilled by Harkins & Co. at 1-A Heaton, in the Manuel Manchaca Survey, is 15 miles southeast of Yoakum. Barry field, discovered in 1950, is productive both from Yegua and Wilcox.

Mississippi gas well finally completed

After several questionable attempts, Sun Oil Co. and Humble Oil Co. finally have been able to make a gas well at their 1 McDonald wildcat in East Central Walthall County, South Mississippi.

The well opens a new Lower Cretaceous field with production from the Paluxy formation. It flowed 5,880 M.c.f.d. through ¼-in. choke, and 3,450 M.c.f.d. through ⅜-in. choke. Flowing pressures were 3,700 psi. and 4,300 psi., respectively. Gas is dry.

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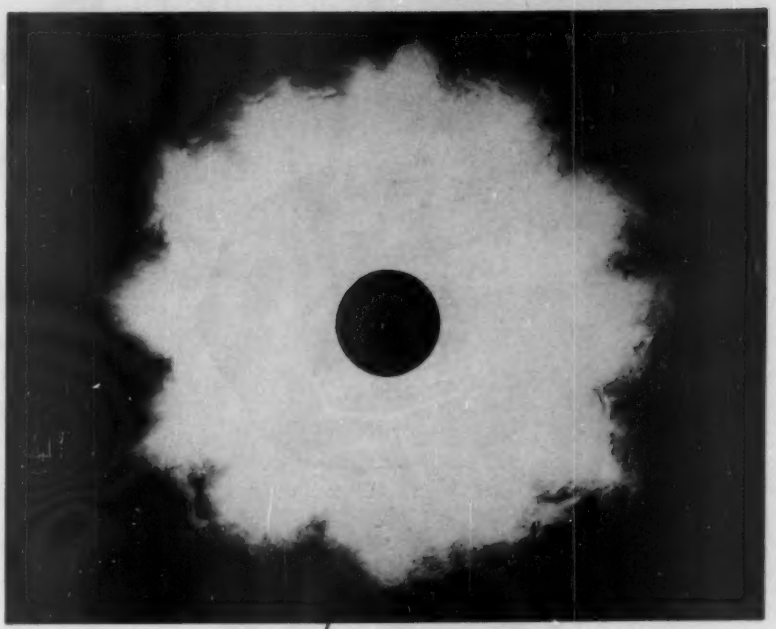

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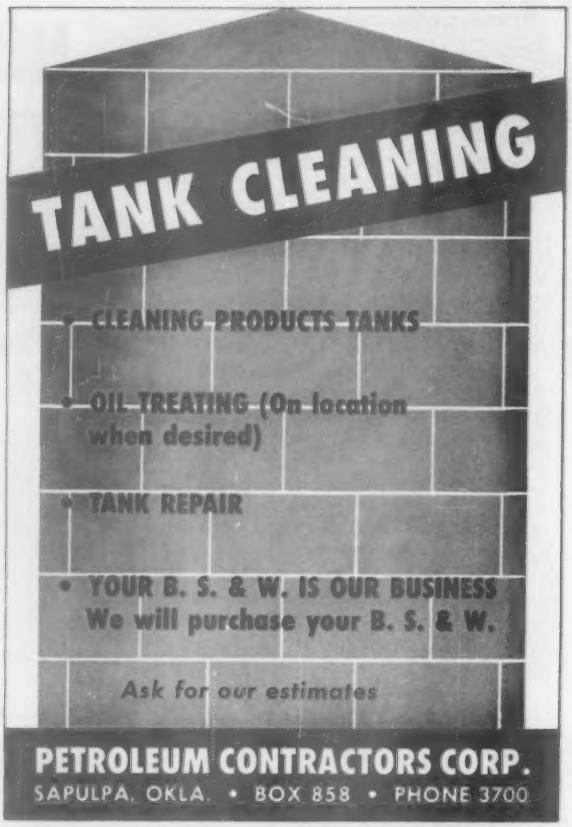
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logged in the Paluxy with hole drilled to 13,891 ft. Present completions is from perforations at 12,938-60 ft. Other zones logged are at 13,313-22 ft. and 13,252-62 ft. Test of the lower zones got a flow of only 200 M.c.f.d.

Location of the well, in 26-3n-11e, is 7 miles northeast of Tylertown. It is 15 miles northwest of Dexter field, nearest Lower Cretaceous field and also productive of gas from the Paluxy member.

Slim-hole opens Mississippi field

A slim-hole wildcat drilled by Serio-Punches Oil Co. in the southwest corner of Adams County, southwestern Mississippi, is opening another Wilcox field.

The wildcat, 1-D Norman Breaux, is productive from the Minter zone, perforated at 6,917-21 ft. It flowed 107 bbl. of 48.3°-gravity oil daily through 12/64-in. choke. Bottom is 7,008 ft.

Glasscock is the name chosen for the new field. It is 2½ to 3 miles northeast of East Fairview field.

Far North test is abandoned

In N. W. T. Richfield Oil Corp. together with the French Petroleum Co., Clark Oil & Refining, Canadian Devonian Petroleums, Ltd., and Hudson's Bay Oil & Gas Co., has recently completed drilling operations at Richfield et al. 1 Grandview Hills. This well is in the Lower Mackenzie basin area of the Northwest Territories, approximately 45 miles north of the Arctic Circle. The well was spudded on December 26, 1959, and after an elapsed time of 102 days, was abandoned at a total depth of 6,555 ft. in sediments believed to be of Silurian-Ordovician age.

This well, drilling by Peter Bawden Drilling, is the first test to be drilled on a 3.5-million-acre block originally acquired from Scurry-Rainbow Oil, Ltd. A second test is scheduled for late this summer.

Alberta wildcat is producer

In Alberta, Jefferson Lake Petrochemicals of Canada, Ltd., announced their Jeff Lake 11-1-26-29 well had produced 7.8 M.M.c.f.d. rate on a drill-stem test of the Elkton formation from 7,267 to 7,368 ft.

The well is on the Mobil Oil Co. farmout lands, on which the company has now successfully developed seven gas wells in either the Crossfield or Elkton formations.

Similar tests in the Elkton formation of the Calgary field generally produce about 5.5 M.M.c.f.d., H. W. Manley, Jefferson vice president said, with this new well indicating approximately 40% greater flow.

Other operators participating in this well are Banff Oil, Ltd., Britalta Petroleums, Ltd., Canada Oil Lands, Ltd., and Lethman Bros.

Manley said the 100-ft section of Elkton formation developed in this well indicated the present proven area of 37,000 acres would extend the field to the north and northeast. Jefferson will continue drilling to test the Crossfield formation at approximately 8,600 ft.

Discovery wells

CALIFORNIA

Tehama County:

Buttes Gas & Oil Co. 1E Corning Community, NW SW 1-24n-3w, 8 M.M.c.f.d., 1-in. choke, perfs. 1,086-1,101 ft., TD. 1,162 ft. (Shallow pool discovery in Corning North Dome gas field).

WESTERN CANADA

Alberta:

Amerada Crown 6-29 Willisden Green, LSD 6, 29-42-7w5. Oil discovery. TD 8,620 ft.

CPOG 7-27 North Standard, LSD 7, 27-26-22w4. Viking gas discovery. TD 5,000 ft.

Hudson's Bay-Union 4-24 Kaybob, LSD 4, 24-62-20w5. Viking gas discovery. TD 10,895 ft.

Pan American D-1 11-20 Pigeon Lake, LSD 11, 20-46-27w4. Basal Quartz gas discovery. TD 7,353 ft.

Texaco-British American 14-15 West Fenn, LSD 14, 15-36-21w4. Viking gas discovery. TD 7,548 ft.

TexCan-Amerada 14-29 Snipe Lake, LSD 14, 29-69-19w5. Oil discovery. TD 9,513 ft.

Northwest Territories:

Home-Signal-CSP 2 Celibeta, 60°, 07′, 22″ north, 122° 05′ 42″ west. Gas discovery. TD 4,115 ft.

NORTH LOUISIANA

Concordia Parish:

Eagle Drilling & Development Co. 3 Sharp, 22-4n-9e. IP 66 BOPD, 7/64-in., 39.2°, TP 585 psi., GOR 275 cu. ft. per bbl., perf. 6,921-23 ft., Wilcox (State-A sand). TD 7,210 ft. New pay in South Roseland field.

Germany-Gulmon L-J Sharp, 16-4n-9e, 1 mile southeast of Ashland. IP 90 BOPD, 10/64-in., 44.8°, TP 150 psi., GOR 200 cu. ft. per bbl., perf. 7,113-25 ft., Wilcox-Walker sand. TD 7,250 ft. Newfield discovery 1 mile south of Roseland field.

Tensas Parish:

La Grange Petroleum Co., Estate of William Helis, and Pioneer Oil & Gas Co. 1 Anderson, 26-12n-11e, 1½ miles northeast of Crimea. IP 200 BOPD, 8/64-in., 41°, TP 1,550 psi., GOR 525 cu. ft. per bbl., perf. 8,691-98 ft., Washita-Fredericksburg. TD 8,780 ft. Discovery well of Buckhorn field.

SOUTH LOUISIANA

Acadia Parish:

Tidewater Oil Co. 1 W. W. McBride et al., 37-11s-1w. IP 30 BOPD, adjustable choke, 51.3°, TP 6,400 psi., GOR 29,008 cu. ft. per bbl., perf. 11,338-40 ft. TD 12,395 ft. New pay in Gueydan field.

Calcasieu Parish:

The California Co. et al. 1 Desire Lorraine et al. Unit 1, 31-10s-5w, 2 miles northwest of Hayes field. IP 114 BOPD, 8/64-in., 42.2°, TP 1,150 psi., GOR 1,320 ft. per bbl., perf. 10,528-42 ft. TD 11,778 ft. Discovery well of North Hayes field.

Plaquemines Parish:

Shell Oil Co. 1 Pottharst, 52-20s-29e. Shut-in gas well, no gage, perf. 9,005-10 ft. TD 9,888 ft. Second well and new pay in Buras field.

St. John the Baptist Parish:

F. A. Callery-Pioneer Oil Co. 2 Lutcher-Moore, 1-11s-7e, 1 mile north of La Place field. IP 144 BOPD, 6/64-in., 48°, TP 1,535 psi., GOR 882 cu. ft. per bbl., perf. 9,037-41 ft. TD 10,460 ft. Discovery well of Frenier field.

MICHIGAN

Jackson County:

Bell & Gault Drilling Co. 1 Prichard, C SW SW 11-1s-3w, 11 miles northeast Albion oil field. IP 6,200 M.c.f.d. Elev. 937, Salina A-1 3,452, Trenton 4,563, pay 4,664 to 4,702. TD 5,075 ft. New gas pool.

NEW MEXICO

Chaves County:

Harold Eide, Jr. 1 Magnolia-State, 17 miles east of Roswell in 11-11s-27e. IPP 3 BO and 2 BW in 24 hours, top pay 943 ft. Permian 943-1,016 ft. TD 1,034 ft. New oil discovery.

Eddy County:

J. Glen Bennett 1 Pardue, 3 miles northwest of Loving in 12-23s-27e. IPP 30 BOPD, 41°, Delaware 2,349-52 ft. TD 2,387 ft. New oil discovery.

EAST TEXAS

Cass County:

Shell Oil Co. 1 Allsup, B. F. Lynn Sur., A-651, 2½ miles southeast of Bryans Mill. IP 22 M.M.c.f.d., calculated open-flow, 233 BC per M.M.c.f., 59° perf. 10,297-10,367 ft., Smackover. TD 10,603 ft. Discovery well of Bryans Mill field.

Rusk County:

Texas Eastern Transmission Corp. 1 Mrs. Leona Pinkerton, A. M. McKnight Sur., A-570, 3½ miles east of Minden. Calculated open-flow potential 14 M.M. c.f.d., 47.2 BC per M.M.c.f., 63.1°, perf. 7,088-98 ft., upper Pettus, 17 M.M.c.f.d., 22.3 BC per M.M.c.f., 62.6°, perf. 7,297-7,306 ft., lower Pettus. TD 7,689 ft. Discovery well of Shiloh field.

TEXAS GULF COAST

Brazoria County:

Gulf Oil Corp. 1 Brundrett, William Parker Sur., A-104, 6 miles northwest of Angleton. IP 123.69 BOPD, 7/64-in., 32.1°, TP 2,150 psi., GOR 7,524 cu. ft. per barrel, perf. 8,562-69 ft., Frio. TD 9,275 ft. New pay in West Chenango field.

Gulf Oil Corp. 1 Bingham-Munson et al., William Parker Sur., A-104, 5½ miles northwest of Angleton. IP 118.14 BOPD, adjustable choke, 31.8°, TP

March well completion tally

	TOTAL COMPLETIONS							WILDCAT WELLS								
	Total	Crude	Cond.	Gas	Dry	Service	Footage	Total	Crude	Cond.	Gas	Dry	Footage	C.T.	D.D.	Act. op.
Alabama	7	7	0	0	0	0	81,225	0	0	0	0	0	0	0	0	3
Alaska	2	2	0	0	0	0	22,929	1	1	0	0	0	11,315	0	0	6
Arkansas	36	14	0	2	20	0	145,736	8	0	0	0	8	37,226	0	0	53
California	124	77	0	5	41	1	609,237	23	1	0	0	22	103,635	0	0	84
Colorado	61	12	0	2	47	0	289,027	23	0	0	0	23	110,493	0	0	70
Illinois	116	47	0	0	69	0	232,610	35	2	0	0	33	61,945	12	0	219
Indiana	61	17	0	0	44	0	73,785	34	1	0	0	33	41,501	29	0	99
Kansas	245	119	0	8	112	6	865,673	88	12	0	1	75	332,493	11	0	300
Kentucky	132	57	0	36	39	0	232,893	15	5	0	1	9	23,177	98	0	150
Louisiana	295	122	32	19	122	0	2,606,850	50	3	0	3	44	452,441	0	0	361
North	86	42	0	15	29	0	372,562	20	2	0	3	15	103,512	0	0	93
South	150	57	22	4	67	0	1,584,414	26	1	0	0	25	291,457	0	0	220
Offshore	59	23	10	0	26	0	649,874	4	0	0	0	4	57,472	0	0	48
Michigan	64	33	0	1	27	3	219,084	17	0	0	1	16	61,973	27	0	150
Mississippi	81	39	5	2	35	0	809,842	21	0	0	0	21	200,371	0	0	56
Montana	18	6	0	0	12	0	78,580	10	0	0	0	10	39,663	2	0	29
Nebraska	74	20	0	0	54	0	425,300	31	2	0	0	29	156,613	0	1	71
Nevada	2	0	0	0	2	0	7,902	2	0	0	0	2	7,902	0	0	0
New Mexico	149	97	3	15	33	1	704,742	21	3	0	0	18	112,242	49	0	210
West	44	21	3	15	5	0	189,260	4	1	0	0	3	18,169	22	0	107
East	105	76	0	0	28	1	515,482	17	2	0	0	15	94,073	27	0	103
New York	22	13	0	0	2	7	29,700	0	0	0	0	0	0	22	0	11
North Dakota	30	24	0	0	6	0	200,468	4	3	0	0	1	34,322	0	1	31
Ohio	73	32	0	13	28	0	177,456	2	0	0	1	1	5,335	70	0	191
Oklahoma	298	144	8	32	109	5	1,379,496	58	14	2	8	34	282,836	29	19	651
Pennsylvania	61	21	0	23	9	8	173,489	1	0	0	1	0	8,435	56	0	41
South Dakota	7	3	0	0	4	0	52,650	2	0	0	0	2	9,938	0	0	8
Texas	1,374	718	69	46	497	44	5,830,269	273	12	4	2	255	1,206,981	61	16	1,021
District 1	96	51	2	5	37	1	265,558	29	0	0	1	28	85,640	2	2	25
District 2	62	15	13	5	29	0	440,513	14	0	1	0	13	99,021	0	3	60
District 3	88	40	12	3	33	0	616,919	15	1	1	0	13	136,212	0	3	91
District 4	91	18	21	5	46	1	521,509	32	1	1	0	30	176,975	0	1	76
East (5&6)	91	55	4	0	32	0	486,725	16	0	0	0	16	94,667	0	2	64
District 7-B	216	87	1	5	113	10	603,745	65	2	0	0	63	165,600	0	2	77
West (7-C&8)	348	250	9	3	81	5	1,780,582	54	4	1	0	49	281,517	20	1	409
District 9	291	148	1	8	107	27	723,783	38	4	0	0	34	104,855	39	2	122
District 10	91	54	6	12	19	0	390,935	10	0	0	1	9	62,494	0	0	97
Utah	25	10	0	0	15	0	135,359	9	0	0	0	9	48,916	0	0	49
West Virginia	69	5	0	56	7	1	160,221	0	0	0	0	0	0	64	0	191
Wyoming	80	38	1	3	38	0	420,300	36	4	1	0	31	188,048	4	3	168
Total Mar. 1960	**3,506**	**1,677**	**118**	**263**	**1,372**	**76**	**15,964,823**	**764**	**63**	**7**	**18**	**676**	**3,537,801**	**534**	**40**	**4,223**
Total Feb. 1960	3,062	1,393	71	293	1,191	114	12,775,800	666	74	3	25	564	2,990,006	614	41	4,371
Cumulative 1960	**10,791**	**5,041**	**350**	**903**	**4,173**	**324**	**47,103,266**	**2,381**	**215**	**22**	**70**	**2,074**	**10,883,829**	**1,829**	**111**	....
Cumulative 1959	11,911	5,970	305	855	4,465	316	50,396,181	2,345	248	33	80	1,984	11,659,819	...	..	....

Note: C.T.=Cable-tool comp. D.D.=Drilled deeper. Act. op.=Active operations.

. . . and in Canada

	Total	Oil	Gas	Dry	Service	Footage	Cum. 1960	Total	Oil	Gas	Dry	Footage	Cum. 1960
Alberta	161	93	15	52	1	1,046,102	479	46	8	9	29	258,612	140
Saskatchewan	41	32	1	8	0	164,860	126	7	0	1	6	32,316	31
Manitoba	5	4	0	1	0	10,272	20	0	0	0	0	0	5
British Columbia	32	12	4	16	0	157,270	70	20	2	3	15	105,000	38
Northwest Territories	6	0	1	5	0	20,975	8	6	0	1	5	20,975	8
Total	245	141	21	82	1	1,399,479	703	89	5	15	69	536,982	222
Ontario	19	3	4	8	4	26,076	65	..	..	..	..	.....	...

2,950 psi., GOR 12,500 cu. ft. per barrel, perf. 8,932-37 ft., Frio, and 51.64 BOPD, 31.8°, GOR 1,850 cu. ft. per barrel, perf. 8,182-85 ft., Frio. TD 10,550 ft. Discovery well of West Chenango field, northwest flank of Chenango field.

Harris County:

Republic Natural Gas Co. et al. 1 Joseph Hornberger et al., Blunt M. Sessums Sur., A-733, 2½ miles north of Channelview. AOF 1,900 M.c.f.d., GLR 16.7 M.c.f. per barrel, 61.2°, shut-in TP 4,456 psi., perf. 10,004-13 ft. TD 10,700 ft. New reservoir and extension discovery in North Channelview area.

Jefferson County:

Meredith & Co. et al. 1 A. P. Daniel, HT&B Sur. 13, A-147, 7 miles northeast of Fannett. IP 157 BOPD, ⅛-in., 37.3°, TD 1,160 psi., GOR 701 cu. ft. per barrel. perf. 7,512-17 ft., upper Hackberry "B" sand, and AOF 315 M.M. c.f.d., GLR 36,150 cu. ft. per barrel, 47.9°, shut-in TP 2,585 ft. New reservoir and extension discovery in South China field.

Pan American Petroleum Corp. 3 Gilbert, Blk. 4, Range 10-K, W. Kyle Sur. A-413, 2 miles northeast of Port Acres. AOF 19 M.M.c.f.d., GLR 20.6 M.c.f. per barrel, 53°, shut-in TP 8,489 psi., perf. 12,674-90 ft., Vicksburg. TD 12,720 ft. New pay in Port Arthur field.

Jefferson County:

Meredith & Co. et al. L. Tyrrell Trust,

March footage breakdown

	FIELD WELLS					WILDCAT WELLS			
	Oil	Cond.	Gas	Dry	Service	Oil	Cond.	Gas	Dry
Alabama	81,225	.....	.....	.....	.....	.....	.....	.....	.....
Alaska	11,614	.....	.....	.....	.....	11,315	.....	.....	.....
Arkansas	52,248	.....	10,920	45,342	.....	.....	.....	.....	37,226
California	373,189	.....	26,288	101,925	4,200	12,033	.....	.....	91,602
Colorado	58,022	.....	11,080	109,432	.....	.....	.....	.....	110,493
Illinois	107,395	.....	.....	63,270	.....	6,093	.....	.....	55,852
Indiana	19,966	.....	.....	12,318	.....	1,590	.....	.....	39,911
Kansas	346,589	.....	36,853	130,768	18,970	45,596	.....	4,607	282,290
Kentucky	63,202	.....	97,393	49,121	.....	6,379	.....	923	15,875
Louisiana	909,902	399,835	97,244	747,428	.....	27,398	.....	11,597	413,446
North	133,511	.....	66,159	69,380	.....	16,030	.....	11,597	75,885
South	549,563	277,927	31,085	434,382	.....	11,368	.....	.....	280,089
Offshore	226,828	121,908	.....	343,666	.....	.....	.....	.....	57,472
Michigan	116,226	.....	.....	37,923	2,962	.....	.....	5,075	56,898
Mississippi	404,017	59,130	13,556	132,768	.....	.....	.....	.....	200,371
Montana	34,845	.....	.....	4,072	.....	.....	.....	.....	39,663
Nebraska	108,136	.....	.....	160,551	.....	12,503	.....	.....	144,110
New Mexico	402,606	19,957	80,375	86,519	3,043	10,664	.....	.....	101,578
West	66,045	19,957	80,375	4,714	.....	6,652	.....	.....	11,517
East	336,561	.....	.....	81,805	3,043	4,012	.....	.....	90,061
Nevada	.....	.....	.....	.....	.....	.....	.....	.....	7,902
New York	17,550	.....	.....	2,150	10,000	.....	.....	.....	.....
North Dakota	131,238	.....	.....	34,908	.....	28,042	.....	.....	6,280
Ohio	76,307	.....	36,696	59,118	.....	.....	.....	3,657	1,678
Oklahoma	567,506	61,199	144,935	305,660	17,360	81,403	14,606	43,864	142,963
Pennsylvania	31,099	.....	79,249	37,615	17,091	.....	.....	8,435	.....
South Dakota	25,482	.....	.....	17,230	.....	.....	.....	.....	9,938
Texas	2,804,581	593,069	202,154	902,292	121,192	71,687	42,885	6,170	1,086,239
Dist. 1	121,717	21,145	14,931	21,432	693	.....	.....	1,405	84,235
Dist. 2	90,422	120,794	25,732	104,544	.....	.....	11,893	.....	87,128
Dist. 3	215,507	115,774	15,558	133,868	.....	10,300	10,107	.....	115,805
Dist. 4	57,200	169,799	28,483	80,852	8,200	1,500	5,585	.....	169,890
East	274,796	29,673	.....	87,589	.....	.....	.....	.....	94,667
Dist. 7-B	263,485	1,760	13,603	140,234	19,063	4,322	.....	.....	161,278
West	1,234,648	79,983	15,100	148,385	20,949	34,426	15,300	.....	231,791
Dist. 9	346,743	5,100	51,070	143,728	72,287	21,139	.....	.....	83,716
Dist. 10	200,063	49,041	37,677	41,660	.....	.....	.....	4,765	57,729
Utah	58,303	.....	.....	28,140	.....	.....	.....	.....	48,916
West Virginia	9,832	.....	130,550	18,189	1,650	.....	.....	.....	.....
Wyoming	179,547	.....	18,488	34,217	.....	24,955	11,265	.....	151,828
Total U. S.	**6,990,627**	**1,133,190**	**985,781**	**3,120,956**	**196,468**	**339,658**	**68,756**	**84,328**	**3,845,039**

	Oil	Gas	Dry	Service	Oil	Gas	Dry
Alberta	588,146	25,142	48,533	5,590	24,671	82,697	271,323
Saskatchewan	124,924	.....	7,620	.....	.....	8,675	23,641
Manitoba	8,146	.....	2,126	.....	.....	.....	.....
British Columbia	41,840	6,550	3,880	.....	8,300	18,398	78,302
Northwest Territories	.....	.....	.....	.....	.....	4,115	16,860
Total	763,056	31,692	62,159	5,590	32,971	113,885	390,126

Lot 65, Theodore F. Koch Sub., F. Valmore League, A-54, 2¼ miles northeast of Winnie. IP 199.2 BOPD, 8/64-in., 38.1°, TP 1,160 psi., GOR 525 cu. ft. per barrel, perf. 8,930-35 ft., Frio. TD 10,416 ft. New pay in North Winnie field.

Liberty County:

Union Producing Co. 1 Ellen Virginia Daniel, Jose Coronado Sur., A-14, 3 miles north of Liberty. IP 535 M.c.f.d., 13.8 BCPD, ⅛-in., TP 980-1,740 psi., perf. 10,443-53 ft. TD 11,519 ft. New-field discovery—Sandune area.

WEST CENTRAL TEXAS

Shackelford County:

Wm. D. Austin et al. 1-A J. F. Dyer, 15 miles south of Albany in Sec. 86, Blk. 12, T&P Sur. IPF 408 BOPD, 16/64-in. choke, open hole, Ellenburger at 4,462 ft. 44°. TD 4,505 ft. New oil discovery.

Katz Oil Co. 1 T. G. Hendrick Est., OWWO, 12 miles northeast of Lueders, 3 miles southwest of Nail Cook sand field in Sec. 179, ETRR Sur. IPF 114 BOPD, 16/64-in. choke, lower Gardner sand 4,104-10 ft., 40.1°. TD 5,207 ft. PB 4,210 ft. New oil pool.

Stephens County:

Currey Oil Co. 1 John Pratt, 2 miles southeast of Eliasville in Sec. 1022, TE&L Sur. A-435. IPF 129 BOPD, 11/64-in. choke, 43.5°, Mississippi lime 4,390-4,412 ft. TD 4,417 ft. New oil discovery.

WEST TEXAS

Dawson County:

Amerada Petroleum Corp. 1 A. F. Miles, 3 miles southwest of Lamesa in Sec. 15, Blk. 36, T-5-N, T&P Sur. IPF 380 BOPD, ½-in. choke, 36.6°, GOR 730:1, TP 120 psi. Spraberry 7,638-8,058 ft. TD 11,711 ft.; IPF 520 BOPD, 20/64-in. choke, Mississippian 11,310-11,390 ft. GOR 586:1, TP 225-350 psi., 37.6°. Dual oil discovery.

Mitchell County:

McCulloch Oil Exploration Co. of California Inc. 2 York, 7 miles northwest of Westbrook in Sec. 19, Blk. 28, T-1-N, T&P Sur. IPF 100 BOPD, 26°, Glorieta 2,413-2,560 ft. TD 2,900 ft. IPF 68 BOPD, 25°, Clear Fork 2,604-2,849 ft. Dual zone oil discovery.

Pecos County:

Midwest Oil Corp. 1 University, 25 miles east of Fort Stockton, Sec. 6, Blk. 20, Univ. Lands Sur. IPF 248 BOPD, 43°, Ellenburger 6,810-40 and 6,862-95 ft. TD 7,005 ft. New oil discovery.

Mobil Oil Co. 1 Kathleen J. Moore, 22 miles northwest of Fort Stockton in Sec. 19, Blk. 48, T-8, T&P Sur. IPCAOF 105 M.M.c.f.d., GOR 64,000:1, Pennsylvanian 15,041-15,147 ft. TD 15,300 ft. Deepest producer in West Texas

Ward County:

Mobil Oil Co. 1-57 George Sealy "C," 3 miles northwest of Wickett in Sec. 57, Blk. F, G&MMB&A Sur. IPF 82 BOPD, 24/64-in. choke, 36.1°, Pennsylvanian open hole 10,820-99 ft. GOR

(Continued on page 214)

Lloyd Elkins . . . the scientist must be a salesman.

AIME Nominates Researcher

● Pan American's Lloyd Elkins is firm believer in following up laboratory work with tests in the field.

OIL RESEARCH is only half done when a new formula is established, a new practice proved, or a better way to handle some field or plant problem devised.

The other half of research requires the researcher to see that his ideas are taken to the field.

Then, he must be available on the coaching lines until the development is put to practical use.

A firm believer in this extended responsibility for following research through the theoretical stage to practical operation is Lloyd E. Elkins, Tulsa, production research director for Pan American Petroleum Corp.

Elkins puts it this way:

"Industrial research has two principal objectives. First, we must formulate and develop new methods of technology. Second, we must assist the operating engineer in incorporating new technology into his regular practice. Products of research are ideas, information, and advice. These are worthless unless used in operations."

He compares a research organization to a library, where valuable information is accumulating day by day.

"This know-how can be advertised, distributed, and even given a hard sell, but it cannot be thrust on anyone," he explains. "It has to be sought and then carefully considered by the user before a company can benefit."

Right at this point, the scientist must turn salesman. Elkins doesn't want to "force" lab-proved ideas on field management. But, by gradually developing a closer liaison between field management groups and the laboratory testing rooms, acceptance of new procedures can be speeded up.

Elkins soon will be in a position to give his research ideas the industry-wide hard sell.

He has been nominated as president-elect of the American Institute of Mining, Metallurgical and Petroleum Engineers (AIME). He would take office in February 1961 as president-elect and become president the next year.

Being nominated for this high spot is a natural. Since 1945, he has been a front-line force in AIME's operations.

He has served as chairman of the Mid-Continent section, vice chairman of the AIME petroleum division, chairman of the petroleum branch, vice president of AIME's petroleum section, and an AIME director. He has been AIME vice president since 1953.

A lengthy listing of his extra-curricular accomplishments doesn't tell the story of Elkins' impact on oil. At 48, he has made challenging strides in a 26-year oil career.

I'm convinced," he says, handling a blackened core at his desk in one of the world's top oil-science centers, "that the increased emphasis on reducing costs and increasing profitability will force technology to play a greater role. This means more scientific and engineering brainpower — not necessarily more bodies. Science and engineering will justify changes in tradition in many areas of practice."

Pan Am career . . . Researcher Elkins is a one-company career man.

He was born near Golden, Colo., went through grade and high school there, and obtained his petroleum engineering degree from the Colorado School of Mines.

Elkins joined some other college seniors in a trip to the International Petroleum Exposition in Tulsa in May 1934. He spent most of his time visiting oil-company offices, applying for a job.

He rushed back to Golden for his diploma, married, and in 2 weeks returned to Tulsa to continue the job

▶▶▶ Personals

Joseph J. Lawnick, American Petrofina, Inc., has been elected chairman of the Southwest Texas section of AIME's Society of Petroleum Engineers. He succeeds **W. J. Bielstein,** Humble Oil & Refining Co. Other officers are **J. R. Hendrix,** Oil Well Supply Division of U. S. Steel, first vice chairman; **R. L. Johnson,** Sun Oil Co., second vice chairman; and **J. N. Holland,** Rockwell Manufacturing Co., secretary-treasurer.

C. W. Lubbock has been promoted to senior staff engineer in the technical division of Humble Oil & Refining Co.'s Baytown, Tex., refinery.

Sam T. Boltz, Jr., production foreman for Texaco Inc. in Meeker, Colo., has been promoted to drilling foreman in Casper, Wyo.

James Dean, assistant manager of Creole Petroleum Corp.'s Tia Juana district, has been transferred to Caracas as assistant manager of the economics department there.

search. He made second trips to 12 or 15 oil companies. Pan American needed an inventory crew man at Wink, Tex.—and Elkins was on his way.

He was a roustabout and later field engineer in charge of testing equipment. At the end of a 2-year hitch there, he projected the possible future life of 60 productive leases in the Wink area in a formal report. His supervisor in Wink advised Elkins, "You're too optimistic," but urged him to send the report to headquarters.

Six weeks later, Elkins was transferred to Tulsa to do a pilot study on depreciation. A company executive questioned him about the Wink lease report. Elkins backed up his findings. The official agreed with him, but added, "My only thought is that you're too conservative."

Two of his bosses were poles apart in appraising his Wink report. The years since have shown Elkins' findings were in the ball park.

Elkins never has left Tulsa. He moved progressively in the Pan Am organization through senior petroleum engineer, petroleum engineering supervisor, assistant chief production engineer, and chief production engineer. Since January 1, 1949, he has been production research director.

Elkins' outside activities include some directly related to oil and research and others dealing with community betterment.

He's taught Sunday School classes since his college days. He's a Presbyterian elder, a member of the board of the Family and Childrens Service Agency of the Tulsa Community Chest, the city-county library board, and the Tulsa city baseball commission.

He has been president of the Engineers Club of Tulsa, is a member of the Tulsa Geological Society, and for 15 years has taken an active part in several professional and scientific societies. He was chairman of the American Petroleum Institute's advisory committee on fundamental research on occurrence and recovery of petroleum from 1951 through 1953. He's a charter member of the Tulsa Petroleum Club.

Dr. James R. Kaiser and **D. K. Shumway** have joined the process research section of Gulf Research & Development Co.'s process division.

John W. Cooke, Jr., chief geologist for Texas National Petroleum Co., has been appointed a vice president. Cooke was with Continental Oil Co. before joining Texas National last year.

Fred G. Crosby has been elected a vice president of Sun Oil Co., Ltd. He will continue as general sales manager and a director of the company. Crosby has been with Sun in Canada since 1931.

O. C. Clifford, Jr., head of Atlantic Refining Co.'s foreign exploration division, will be in charge of the company's new foreign exploration and production department. He will be responsible for development of exploration, drilling, and producing programs in all overseas countries except Venezuela, where Atlantic has an established organization.

W. H. Rosser, regional engineer for Continental Oil Co.'s southern region, Houston, has been promoted to engineering section chief for Continental's interstate gas sales activities, a new position. **Martin D. Rowe, Jr.,** southern region staff engineer, will succeed Rosser as regional engineer. Rosser will continue to headquarter in Houston.

J. H. Manning, zone exploration manager in Regina for British American Oil Co., Ltd., has been appointed zone exploration manager for the new Edmonton exploration zone. **R. N. Taylor,** Edmonton area exploration manager, will succeed Manning in Regina. In other appointments to the Edmonton exploration zone, **J. S. Wonfer,** subsurface geologist, Calgary, will be zone geologist; **J. A. Lawrence,** Edmonton area land man, will be zone land man; **C. E. Sharman,** Edmonton group clerk, will be zone clerk.

Kenneth A. West, manufacturing manager for Canadian Oil Companies, Ltd., has been appointed a vice president. He will be responsible for the manufacturing, supply and transportation, and purchasing departments. West will continue to headquarter in Toronto. West was named manufacturing manager and a member of the management committee in 1955. Before that time he had served Canadian Oil as assistant manufacturing manager, refinery production superintendent, and chief process engineer.

Robert R. Gumaer, senior chemical engineer with American Oil Co. in Texas City, has been transferred to Whiting, Ind., as senior chemical engineer in the research and development department of Standard Oil Co. (Ind.), the parent company.

▶▶▶ Personals

Bruce K. Brown, president of Petroleum Chemicals, Inc., has been elected chairman and chief executive officer of the company, a subsidiary of Cities Service Co. and Continental Oil Co. **Frank M. Perry,** vice president and a director of Cities Service Oil Co. in charge of the natural gasoline and chemical division, will succeed Brown as president of Petroleum Chemicals. **Fred H. Ramseur, Jr.,** coordinator of light hydrocarbons for Cities Service Petroleum, Inc., in New York, will succeed Perry as manager of Cities Service Oil's gasoline division. Ramseur also has been elected a director of the company.

BROWN

PERRY

RAMSEUR

Robert B. Costello, division engineer, construction engineering and inspection, for M. W. Kellogg Co., has been appointed operations manager of the Buenos Aires office of Kellogg Pan American Corp. He will be responsible for engineering, procurement, and construction activities of Kellogg Pan American in Argentina.

W. E. Schoening, district manager in Jefferson City, Mo., for Standard Oil Co. (Ind.), has been named manager of marketing development for American Oil Co. in New York, a new position. In other American Oil appointments, **I. C. Wood,** district sales manager in Richmond, Va., has been named Pittsburgh district manager. He succeeds **W. A. Stone,** who has retired. **J. R. Dague,** assistant district sales manager in Charlotte, N. C., will succeed Wood in Richmond. **R. H. Gravlee,** manager of operations in the New Orleans regional office, has been appointed manager, marketing. He succeeds **R. E. Bowen,** who has been given a special assignment in the New York marketing department. **J. D. O'Reilly,** manager, administrative, in New Orleans, has been named manager, administrative and operations.

Personals

BRIDGEMAN

PATTINSON

GASS

The Hon. **M. R. Bridgeman** will become chairman of British Petroleum Co., Ltd., when **Sir Neville Gass** retires this summer after 41 years with the company and 3 years as chairman. Bridgeman has been a deputy chairman of BP. **J. M. Pattinson,** a managing director, has been named a deputy chairman. **M. A. L. Banks** has been named a director of the company. The appointments are effective July 1.

Roy F. Bennett, former chief geophysicist and foreign exploration manager for Sohio Petroleum Co., has opened offices as exploration consultant in Oklahoma City. Bennett is a past president of Society of Exploration Geophysicists.

William W. Bryan, vice president and member of the board of management of Humble Oil & Refining Co.'s Carter Division in Tulsa, has been transferred to Humble's Houston headquarters office as vice president for marketing. He will coordinate all Humble marketing activities. Bryan joined Esso Standard in 1923. He became vice president in charge of marketing and a director of Carter in 1956.

COX

Delmar L. Cox, staff engineer with Blackwell Oil & Gas Co. in Tulsa, has been promoted to chief engineer of the company. **E. L. Snider,** Cushing, Okla., district engineer for Blackwell, has been transferred to Wichita Falls, Tex., as North Texas district engineer. **Bill Griffin** will succeed Snider as Cushing district engineer. **Dean Swearingen** has joined the company as petroleum engineer in Cushing.

Riley V. Carlton, petroleum engineer in Pan American Petroleum Corp.'s proration section, Fort Worth, has been promoted to area engineer and transferred to Monahans, Tex.

Dr. B. H. Johnson, Dr. F. W. Lampe, and **Dr. A. T. Watson** have been promoted to research specialists in Humble Oil & Refining Co.'s research and development division, Baytown, Tex.

Roy Nystrom, technical superintendent of Creole Petroleum Corp.'s Amuay Bay refinery, has been appointed assistant general manager of the refinery. He succeeds **Montague Ball,** who has been named operations coordinator for Creole's refining department in Caracas.

William T. Robinson, head of the products application and service division in Du Pont Co.'s petroleum laboratory, Deepwater Point, N. J., has been transferred to the Wilmington, Del., office as technical assistant. **Robert O. Braendle,** technical manager of the eastern region in New York, will succeed Robinson. **George A. Finn,** assistant technical manager of the eastern region, succeeds Braendle. **J. Brent Malin,** western region technical manager, has been transferred to the petroleum laboratory as head of the technical information division, a new position. **Anton O. Melby,** technical assistant in new product development, will succeed Malin.

Bill E. Council, district marketing manager in Kansas City for Continental Oil Co., has been promoted to assistant director of technical services in Conoco's marketing department. He will headquarter in Ponca City, Okla. Council succeeds **E. W. Cave,** who has been transferred to Houston as director of aviation sales, a new position.

Paul D. Balbin, general manager of Chaco Petroleum, S.A., in Bolivia, has been named vice president of the company. Chaco, a subsidiary of Tennessee Overseas Co. division of Tennessee Gas Transmission Co., is operator for a group of U. S. companies conducting exploratory operations in southern Bolivia. **Luis G. Morales,** exploration manager for Tennessee Argentina, S.A., has been named vice president of that company. Tennessee Argentina is under contract to YPF, Argentine oil agency, for exploration and development drilling on Tierra del Fuego. Balbin will continue to headquarter in Cochabamba, Bolivia. Morales will continue to headquarter in Buenos Aires.

Leo C. Gravis, chief geologist for Trunkline Gas Co., has been promoted to manager of exploration. He will be in charge of geological, land, and geophysical activities for the company.

Robert M. Lowe, division engineer in Houston for Sohio Petroleum Co., has been transferred to Oklahoma City as head reservoir engineer. **David B. Darden,** geophysicist for Sohio, has been transferred to Houston from New Orleans.

Wilfred C. Hugli, Jr., consultant, has been named manager of operations research for Cities Service Oil Co. Hugli was director of the Stevens Institute of Technology operations research laboratory before becoming a consultant.

MILLIGAN

Robert L. Milligan, president of Pure Oil Co., will succeed **Rawleigh Warner** as chief executive officer of the company next month. Warner will continue as chairman of the board. He has been chairman and chief executive officer since 1947. Milligan has been with Pure since 1929. He had served as vice president, executive vice president, and a director before being named president in 1954.

C. P. Abrassart, Billings, Mont., district geologist for Sinclair Oil & Gas Co., has been transferred to Casper, Wyo. Others moving to Casper from Billings are geologists **A. E. Owen, R. W. Chuman,** and **Robert Allen. Fred S. Johnson,** geologist, has been transferred to Denver from Billings.

Deaths

William M. Cartmell, 53, Albuquerque independent geologist, died April 8 in a Denver hospital after a long illness. Cartmell was with the old Carter Oil Co. in Indiana and Illinois before becoming an independent in the 1940's.

Samuel Eakin Porter, 83, retired driller, died April 10 in a Tulsa hospital. Porter was active in Pennsylvania, Ohio, Oklahoma, and Texas fields before his retirement in 1944.

Charles Tripler Shewell, 57, senior research specialist for Humble Oil &

FOY WRIGHT POWELL MILLER

Pipeline Division Managers Named

DIVISION offices of Magnolia Pipe Line Co. have been reduced from five to four as part of a major realignment of field operations of the Dallas-based company. Managers of the four divisions will be M. E. Powell, Houston; K. W. Miller, Midland, Tex.; J. R. Wright, Wichita; and L. A. Foy, Plainfield, N. J. Magnolia also has trimmed district offices from 19 to nine, with eight supervisory areas reporting to the district offices. District headquarters within the Houston division will be in Alice, Beaumont, and Corsicana, Tex. Area supervisors will headquarter in Corpus Christi and Greggton, Tex. District headquarters in the Midland division are Wichita Falls, Midland, and Brownfield, Tex. Area supervisors are in Andrews, Tex., and Healdton, Okla. Wichita division will supervise district offices in Augusta and Hill City, Kans., and Salem, Ill., with an area office in Casper, Wyo. Plainfield division will have area offices in Harrisburg, Pa., Rochester, N. Y., and East Douglas, Mass.

James C. Preston, manager of Michigan Consolidated Gas Co.'s Cadillac, Mich., district, has been named general manager of central and northern Michigan operations. **Reno J. Maccardini,** northern district engineer, has been promoted to assistant general manager. Both have headquarters in Mount Pleasant. **Thomas K. Horton,** sales supervisor in the Mount Pleasant district, will succeed Preston in Cadillac.

Robert H. Grimes, Jr., oil traffic engineer in Lubbock, Tex., for Service Pipe Line Co., has been promoted to engineer, senior grade. He succeeds **C. F. Simes,** who recently was named Lovington, N. M., district superintendent. **Merlin T. Bender,** engineer in the Lovington district, will succeed Grimes in Lubbock. **Dale Burton,** engineer, junior grade, in Tulsa, will succeed Bender.

Don Miller, president of Skelly Oil Co., has been elected a director of Great Lakes Pipe Line Co.

Carroll C. Cook has been named project manager in Delhi-Taylor Oil Corp.'s special projects and planning department. Cook had been assistant to senior vice president **Fred P. Sewell.**

▶▶▶ Personals

J. J. Dvorak has been promoted to assistant technical division head in Humble Oil & Refining Co.'s Baytown, Tex., refinery.

J. R. Parten, president of Woodley Petroleum Co. before its sale to Pure Oil Co., has been elected a director of Pure.

John B. Rowland, Sinclair Oil & Gas Co.'s Drumright, Okla., district production superintendent, has retired after 40 years with the company.

G. W. McMillan, senior geologist in Tennessee Gas & Oil Co.'s Canadian division, has been promoted to district geologist in Calgary. **R. I. Standen,** land man, has been named district land man, Calgary.

Donald M. Cox, general manager of the supply department of Humble Oil & Refining Co.'s Esso Standard Division in New York, has been appointed manager of supply and distribution for Humble in Houston, a new position. Cox will coordinate supply and distribution for all Humble divisions. This will include crude-oil supplies, product purchases and sales, and transportation.

Dr. Parke A. Dickey has rejoined Jersey Production Research Co. in Tulsa after a 20-month special assignment in Venezuela as western division geological exploration section head for Creole Petroleum Corp. in Maracaibo. Dickey succeeds **Dr. R. W. Landes** as manager of the geological division for Jersey Production Research. Dr. Landes will return to Imperial Oil Ltd. in Calgary in June.

Refining Co. at the Baytown, Tex., refinery, died April 7 at his home in Baytown after a heart attack. Shewell had been with Humble 25 years.

Clay King Clark, retired DX Sunray Oil Co. engineer, died April 10 in a Cushing, Okla., hospital.

Walter W. Clopton, former manager of United Gas Pipe Line Co.'s San Antonio, Tex., district, died April 7 in San Antonio.

Frederick C. Ripley, 83, former general manager of the old Chanslor-Canfield Midway Oil Co., died recently in Los Angeles.

Willis L. Lea, Jr., vice president and general attorney for Southern Union Gas Co., died April 9 while on a fishing trip near Breckenridge, Tex. He had been with Southern Union since 1936 and had been a vice president since 1955.

Russell V. Forester, 52, communications engineer for Shell Pipe Line Corp., died April 11 at his home in Houston after an illness of several months. He had been with Shell since 1933.

R. L. (Dick) Griffin, 66, retired Tulsa pipeline contractor, died April 8 in a Tulsa hospital.

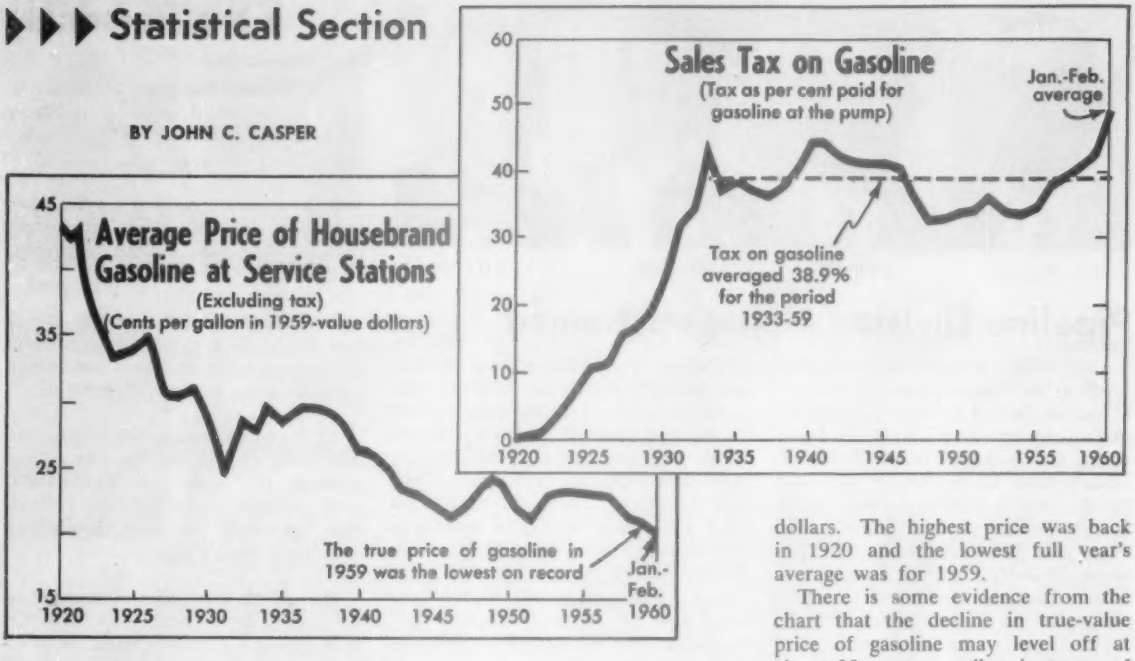
James Harry Macmillan, 82, one of the founders of Macmillan Petroleum Corp., died April 11 after an illness of several months. Macmillan was active in development of Signal Hill field during the 1920's and in recent years had worked with Macmillan Petroleum's Sicilian exploration plans.

Dr. S. F. Birch, 61, research associate in the London petroleum chemicals department of British Petroleum Co., Ltd., died March 25. Birch had been with BP since 1923.

William B. Klaus, 58, head of Tidewater Oil Co.'s fire protection program, died April 10 in Los Angeles.

▶▶▶ Statistical Section

BY JOHN C. CASPER



Highest-quality gasoline, lowest price in 40 years

GASOLINE IS A BARGAIN. Refiners and marketers know this, but the customer needs to be reminded that he is getting more for his money than he ever did in the past. He is buying higher-quality gasoline at a lower price.

There has been a gasoline price war in Oklahoma since the middle of March. Service-station postings for regular grade dropped from 31.9 cents to 21.9 with a few scattered stations down to 19.9 cents.

On April 9, several stations returned to normal postings of 31.0 cents. A newscaster reported this bit of progress but commented that he could remember when 21.9 cents was the normal price. This brings up a question that has been asked many times. How many customers appreciate the bargain they are getting in today's gasoline?

A casual check with a few motorists seemed to indicate that the oil industry still has a lot of work to do on its public-relations job.

These motorists could remember buying gasoline for 21 cents a gallon. They did not remember just how long it had been. They realized that inflation has cut the value of the consumer dollar but had only a vague idea of what 18-20-cent gasoline in the thirties would amount to in today's devalued dollars.

The motorist can't get a true comparison between today's prices and those of the thirties because all prices are measured in varying-value dollars. You can't measure distance with a rubber tape unless you know how much the tape has stretched. Government reports of prices over the years make it possible to get at least a general idea of how much the dollar has been devalued.

The first chart shows the average price for housebrand gasoline, excluding tax, expressed in 1959 consumer dollars. The highest price was back in 1920 and the lowest full year's average was for 1959.

There is some evidence from the chart that the decline in true-value price of gasoline may level off at about 22 cents a gallon in terms of 1959 dollars. This would mean that current-dollar prices in the future would change with inflation and higher taxes.

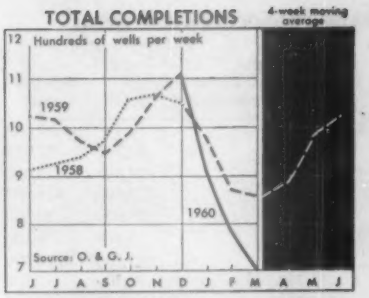
The second chart shows taxes on gasoline, expressed as a per cent of gasoline prices at the pump. Note that this ratio of tax to price has averaged 38.9% over the past 27 years and has shown an upward trend since the end of World War II. The national average of state and federal gasoline taxes topped 10 cents a gallon last October.

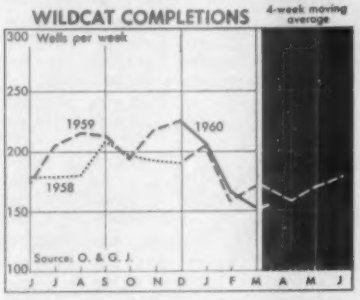
The average tax for 1960 will be almost 50% of the value of gasoline sold at service stations. It will be more than 80% of the average price at the refinery gate.

Highest quality and lowest price in 40 years is something for the service-station operator to brag about. But, he also should tell his customers about the 50% sales tax. That's squawking material.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,048,000	DOWN	123,835	DOWN	214,730
Crude stocks	258,227,000	UP	646,000	UP	5,839,000
Completions	689	DOWN	22	DOWN	156
Refinery runs	8,035,000	UP	119,000	DOWN	57,000
Gasoline stocks	224,995,000	DOWN	600,000	UP	10,401,000
Kerosine stocks	18,221,000	UP	683,000	DOWN	1,060,000
Distillate stocks	74,419,000	DOWN	700,000	DOWN	4,575,000
Residual stocks	39,373,000	UP	261,000	DOWN	18,020,000
Four-product stocks	357,008,000	DOWN	356,000	DOWN	13,254,000
Total imports	1,670,000	DOWN	167,400	UP	264,400





Active Rotary Rigs

	4-11-60	4-4-60	4-13-59
Alabama	4	4	7
Alaska	5	5	(†)
Arkansas	12	17	13
Arizona	4	4	1
California	86	81	98
Land	82	77	96
Offshore	4	4	2
Colorado	21	23	39
Florida	2	2	3
Land	1	1	2
Offshore	1	1	1
Illinois	29	21	32
Indiana	3	2	10
Iowa	0	0	3
Kansas	120	97	136
Kentucky	3	1	7
Louisiana	303	296	332
North	36	29	36
S. Inland waters	128	125	145
S. Land	83	89	107
Offshore	56	53	44
Maryland	0	0	0
Michigan	26	33	15
Mississippi	60	55	69
Missouri	1	1	0
Montana	14	12	21
Nebraska	31	26	28
Nevada	0	0	0
New Mexico	106	108	112
New York	1	1	1
North Dakota	17	21	43
Ohio	4	5	0
Oklahoma	211	197	238
Oregon	0	0	0
Pennsylvania	11	11	11
South Dakota	1	2	2
Texas	629	635	744
S. inland waters	10	8	9
S. Land	156	175	156
Offshore	1	2	1
North	47	47	152
Panhandle	55	65	(*)
East	60	55	(*)
West Central	196	187	271
West	104	96	155
Utah	32	27	32
Washington	0	0	0
West Virginia	4	4	4
Wyoming	60	55	56
Total U. S.	1,800	1,746	2,057
Western Canada	114	140	121
Eastern Canada	2	2	0
Grand total	1,916	1,888	2,178

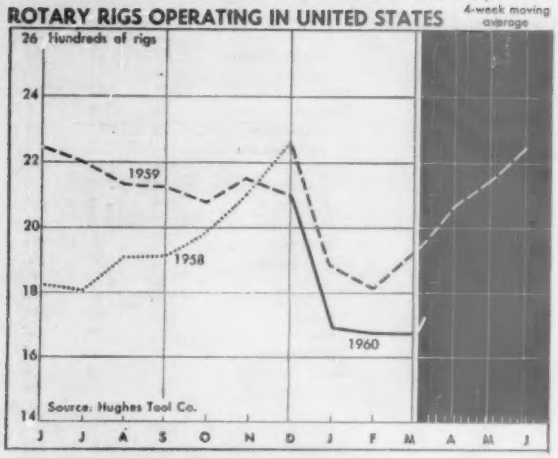
Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED APRIL 9, 1960

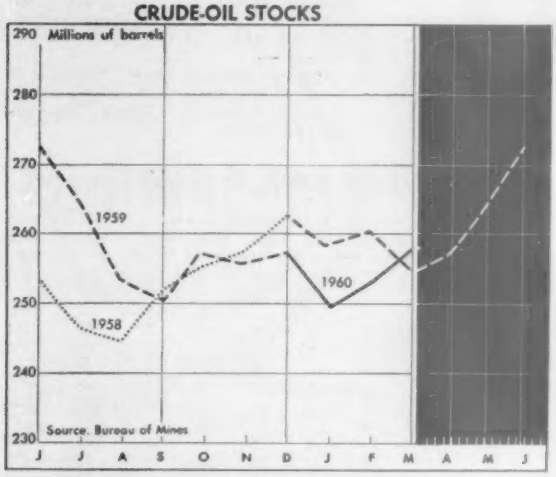
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	15	30	0	0	0	0	0	1	5
Arizona	0	0	0	0	0	0	0	6	.....	0	0	0	0	0	6	.....
Arkansas	11	3	1	0	7	0	48,101	155	245	4	0	1	0	3	41	42
California	21	10	0	4	7	0	99,053	354	417	3	0	0	1	2	76	101
Colorado	12	3	0	0	9	0	52,758	192	200	5	0	0	0	5	88	118
Illinois	14	7	0	0	7	0	25,781	566	565	3	0	0	0	3	149	93
Indiana	6	3	0	0	3	0	10,341	225	174	2	1	0	0	1	96	56
Kansas	40	8	0	0	32	0	145,973	859	1,109	20	2	0	0	18	287	246
Kentucky	7	2	0	0	5	0	11,577	493	431	0	0	0	0	0	59	47
Louisiana	57	16	10	3	28	0	493,011	889	973	11	0	0	0	11	133	126
North	17	4	0	2	11	0	66,554	281	351	4	0	0	0	4	54	58
South	28	8	7	1	12	0	289,383	451	515	6	0	0	0	6	69	64
Offshore	12	4	3	0	5	0	137,074	157	107	1	0	0	0	1	10	4
Michigan	10	1	0	0	9	0	33,681	195	149	7	0	0	0	7	65	46
Mississippi	23	19	0	0	4	0	247,039	227	182	5	2	0	0	3	73	84
Montana	2	1	0	0	1	0	11,687	64	74	0	0	0	0	0	32	31
Nebraska	15	2	0	0	13	0	94,127	206	202	5	0	0	0	5	82	91
New Mexico	27	14	2	6	5	0	136,725	504	490	3	0	0	1	2	67	47
West	11	4	2	5	0	0	59,920	166	.....	0	0	0	0	0	13	.....
East	16	10	0	1	5	0	76,805	338	.....	3	0	0	1	2	54	.....
New York	3	0	0	2	1	0	8,210	100	97	2	0	0	1	1	7	8
North Dakota	3	1	0	0	2	0	24,156	84	122	1	0	0	0	1	13	28
Ohio	28	9	0	6	13	0	64,686	310	257	0	0	0	0	0	14	7
Oklahoma	59	22	1	8	27	1	276,305	991	1,615	9	0	0	2	7	190	250
Pennsylvania	0	0	0	0	0	0	0	128	114	0	0	0	0	0	6	3
South Dakota	1	0	0	0	1	0	3,610	13	.....	1	0	0	0	1	5	.....
Texas	310	159	16	13	115	7	1,463,640	4,345	5,223	67	0	5	0	62	897	997
Dist. 1	22	10	0	0	12	0	64,520	312	336	11	0	0	0	11	115	89
Dist. 2	16	4	5	3	4	0	117,484	191	205	2	0	1	0	1	45	63
Dist. 3	26	5	3	3	15	0	211,283	333	285	9	0	2	0	7	68	74
Dist. 4	22	3	3	3	13	0	120,805	335	328	6	0	1	0	5	101	90
East	6	2	1	0	3	0	33,860	308	304	2	0	1	0	1	63	68
Dist. 7-B	43	20	1	1	21	0	128,888	623	719	14	0	0	0	14	183	194
West	105	72	1	0	26	6	570,322	1,158	1,641	15	0	0	0	15	183	192
Dist. 9	59	41	1	0	16	1	153,870	810	1,003	6	0	0	0	6	115	192
Dist. 10	11	2	1	3	5	0	62,608	275	402	2	0	0	0	2	24	35
Utah	1	0	0	0	1	0	5,810	69	107	0	0	0	0	0	25	29
West Virginia	10	1	0	7	1	1	21,004	210	203	0	0	0	0	0	1	6
Wyoming	17	7	0	2	8	0	92,625	260	232	4	0	0	1	3	106	78
Misc. (Tenn.)	12	0	0	0	12	0	9,222	24	21	12	0	0	0	12	22	17
Total U. S.	689	288	30	51	311	9	3,379,122	11,484	13,232	164	5	6	6	147	2,541	2,556
Previous week	711	345	19	31	300	16	3,273,150	.....	.....	168	16	1	5	146	.....	.....
Cum. 1960	11,484	5,347	380	964	4,466	327	50,719,543	.....	.....	2,541	221	28	76	2,216	.....	.....
Cum. 1959	13,232	6,703	340	903	4,926	360	55,859,804	.....	.....	2,556	264	35	85	2,172	.....	.....
Western Canada	62	40	0	4	18	0	360,720	702	704	20	2	0	3	15	219	269

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	4-2-60	3-26-60	4-4-59
Pennsylvania	2,075	2,072	2,524
Other Appalachian	1,775	1,825	1,547
Illinois, Indiana, Michigan	9,414	9,319	8,568
Nebraska and North Dakota	2,696	2,730	2,181
Kansas	9,464	9,487	8,611
Oklahoma	17,458	16,842	17,135
Arkansas	2,007	2,042	1,847
Louisiana	20,226	19,218	18,041
North	3,341	3,252	3,272
South	16,885	15,966	14,769
Mississippi, Alabama, Florida	2,797	2,931	2,421
New Mexico	7,916	7,329	8,351
Texas	112,147	112,097	109,439
East Texas	8,489	8,617	9,427
West Texas	50,615	50,836	52,782
Texas Gulf	20,060	20,569	17,946
Other Texas	32,983	32,075	29,284
Wyoming	17,423	17,522	13,330
Other Rocky Mountain	9,640	9,657	9,238
California	29,350	29,975	34,468
Foreign	†13,839	14,535	14,687
Total	258,227	257,581	252,388

*Bureau of Mines. †Includes 4,653,000 bbl. in California.

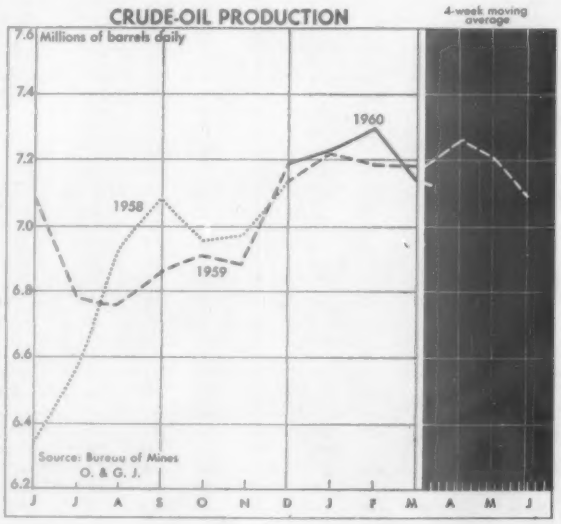
DAILY AVERAGE PRODUCTION FOR WEEK

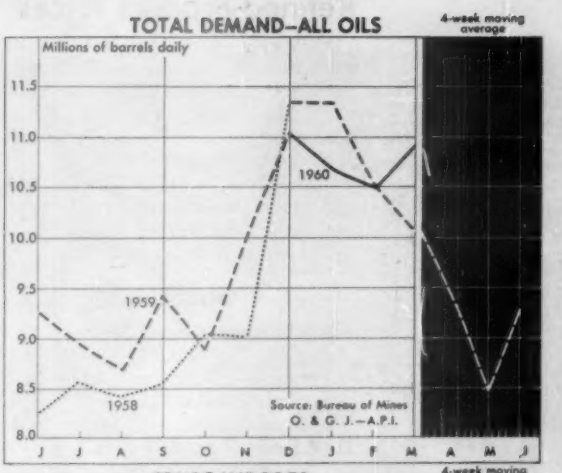
	April 9, 1960 Crude oil	Lease condensate	Total	April 2 total
Alabama	19,225	.....	19,225	19,300
Arkansas	82,550	150	82,700	82,625
California	829,500	.....	829,500	826,000
Colorado	129,500	.....	129,500	128,900
Eastern	39,600	.....	39,600	39,000
Florida	1,100	.....	1,100	1,200
Illinois	213,800	.....	213,800	218,000
Indiana	33,700	.....	33,700	33,400
Kansas	†327,270	.....	†327,270	†323,930
Kentucky	62,600	.....	62,600	62,200
Louisiana	965,750	136,000	1,101,750	1,096,300
North	107,750	6,000	113,750	113,800
South	858,000	130,000	988,000	982,600
Michigan	31,800	.....	31,800	31,800
Mississippi	129,700	4,100	133,800	138,325
Montana	79,200	.....	79,200	79,400
Nebraska	61,400	.....	61,400	61,000
Nevada	100	.....	100	100
New Mexico	304,500	7,500	312,000	315,100
North Dakota	56,000	.....	56,000	52,000
Oklahoma	†545,900	.....	†545,900	†552,100
Texas	2,459,500	91,675	2,551,175	2,674,625
Dist. 1	41,500	3,700	45,200	44,500
Dist. 2	110,000	8,600	118,600	123,100
Dist. 3	311,000	38,000	349,000	363,000
Dist. 4	174,800	18,000	192,800	207,000
Dist. 5	27,500	500	115,800	124,000
Dist. 6	105,800	10,000	115,800	124,000
East Texas field	132,000	.....	132,000	139,000
Dist. 7-B	122,200	250	122,200	137,300
Dist. 7-C	120,100	3,225	123,325	130,525
Dist. 8	1,016,400	5,900	1,022,300	1,073,000
Dist. 9	191,200	2,400	193,600	194,400
Dist. 10	107,000	1,100	108,100	109,300
Utah	108,700	.....	108,700	110,600
Wyoming	326,200	.....	326,200	325,000
Others	‡1,400	.....	‡1,400	‡1,350
Total U. S.	6,808,995	239,425	7,048,420	7,172,255
Change from prev. week, down			123,835	
Canada	†480,000	.....	†480,000	†546,600

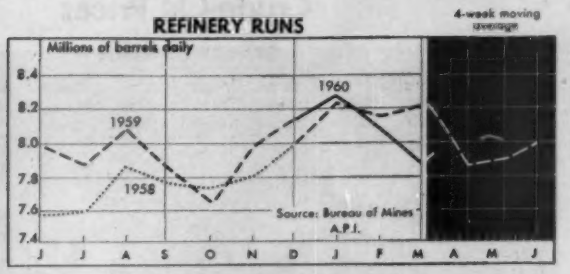
Total U. S. prod., Jan. 1-Apr. 9 ..... 719,509,300 bbl.
Same period last year (crude plus cond.) ..... 713,575,500 bbl.

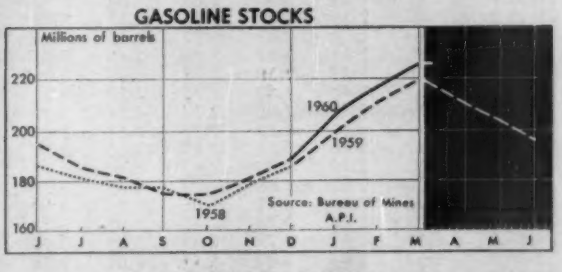
*Includes 19,226,380 bbl. condensate. †Week ended previous Monday. ‡Alaska and South Dakota.

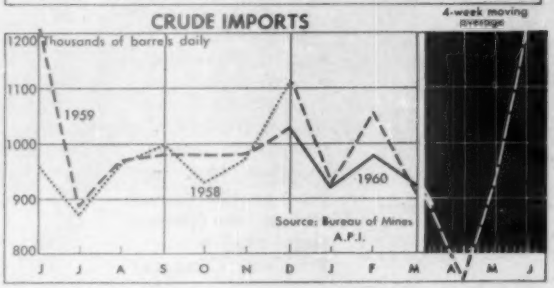
CRUDE-OIL PRODUCTION

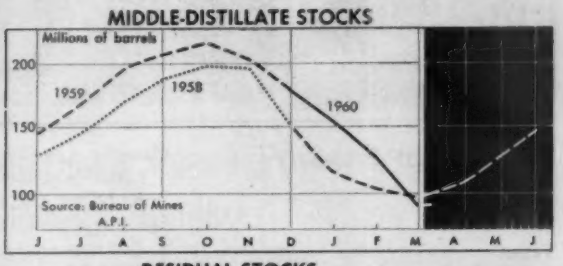


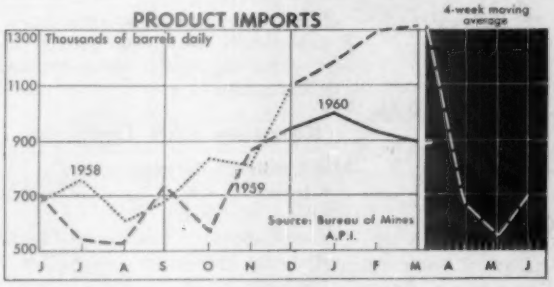


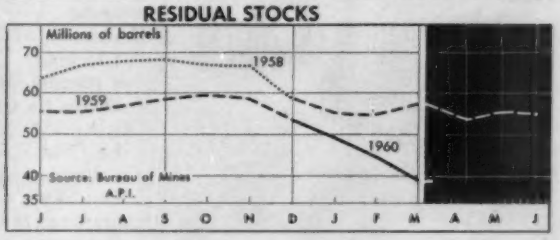












API REFINERY REPORT—APRIL 8, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, April 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,101	550.7	48.3	324.9	185.3	45,324	6,813	22,966	10,676	1,114	489.4	35.1	304.8	167.2
Appalachian:														
District 1	104	44.6	5.1	21.3	12.4	6,128	453	1,761	296	84	31.7	2.9	19.2	8.7
District 2	74	30.9	8.1	9.1	11.1	2,811	278	658	392	91	42.3	5.5	16.5	11.8
Ind., Ill., Ky.	1,487	744.1	82.0	317.7	181.9	43,764	3,212	11,768	3,323	1,421	723.0	68.0	286.5	156.3
Minn., Wis., Dak.	124	60.0	6.4	29.9	16.0	6,867	497	2,448	597	92	43.4	5.6	21.4	11.9
Okla., Kans., Mo.	671	351.6	12.7	151.7	20.4	23,175	712	6,955	920	698	353.5	16.1	158.9	17.5
Inland Texas	268	196.4	5.6	41.8	19.6	7,812	496	1,632	2,395	261	192.8	6.4	47.9	20.5
Tex. Gulf Coast	1,933	938.9	132.1	469.1	160.0	29,084	2,415	8,762	4,945	1,904	966.5	77.8	472.1	164.5
La. Gulf Coast	701	442.7	61.4	145.4	51.9	13,165	1,406	2,293	813	689	363.8	45.3	150.3	43.4
N. La. and Ark.	103	51.0	7.6	21.0	5.3	6,367	498	1,942	141	106	49.0	5.1	22.8	6.3
Rocky Mtn.:														
New Mexico	24	15.0	0.6	4.6	2.7	797	49	149	148	21	11.9	0.3	4.0	2.1
Other	275	132.8	1.4	64.9	33.9	8,019	222	2,311	893	251	110.1	1.6	55.9	31.5
West Coast	1,170	538.4	22.3	204.0	287.1	31,682	1,170	10,774	13,834	1,136	508.4	6.0	179.4	295.3
Apr. 8, 1960	8,035	4,097.1	393.6	1,805.4	987.6	224,995	18,221	74,419	39,373	7,868	3,885.8	275.7	1,739.7	937.0
Apr. 1, 1960	7,916	3,995.4	344.9	1,870.1	973.0	225,595	17,538	75,119	39,112	.....	.....	.....	.....	.....
Apr. 10, 1959	8,092	4,038.3	301.0	1,800.1	969.7	214,594	19,281	78,994	57,393	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.76	....	....	....	....	....	....	....	....
15-15.9	1.84	....	....	....	....	....	....	....	$1.81
16-16.9	1.92	....	....	....	....	....	....	....	1.86
17-17.9	2.00	....	....	....	....	....	....	....	1.91
18-18.9	2.08	....	....	....	....	....	....	....	1.96
19-19.9	2.16	....	....	....	....	....	....	....	2.01
20-20.9	2.24	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.32	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.39	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.55
Middle District	4.37
Southwest Pennsylvania	4.10
West Virginia	3.92
★ Buckeye Grade	3.92
Illinois Basin	**3.00**

Foreign

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.90
Iranian, 34.0°-34.9°, Bandar Masur	1.80
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57
Canada:	
Leduc-Woodbend	$2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 47°-47.9°, Tucupido	3.34
San Joaquin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

★ Gulf-NY, clean (ATRS −10.0%)	$2.57
★ Carib.-NY, dirty (ATRS −60.0%)	1.10
★ Carib.-UK, clean (Scale −31.25%) (22s. 4d.)	3.13
★ PG-UK, dirty (Scale−75.5%) (19s. 5d.)	2.72

★ Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):	
Regular (91 octane)	11.00-11.50
Premium (99 octane)	13.50-14.25
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.25-10.50
Regular (92 octane)	10.50-10.75
Premium (98 octane)	11.25-11.75
California (rack) Los Angeles):	
Regular (88 octane)	11.65-12.15
Premium (94 octane)	12.65-13.15
Premium (100 octane)	14.00-14.65
Caribbean area (cargoes):	
Regular (87 octane)	10.125
Premium (97 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):	
Kerosine 42-44	9.00-9.50
Diesel oil (58 d.i. and above)	8.75-9.25
Distillate No. 1	8.75-9.25
Distillate No. 2	7.75-8.25
Gulf Coast (cargoes):	
★ Kerosine 41-43	8.50-9.00
★ Distillate No. 2	7.50-8.00
New York Harbor (barges):	
Kerosine 41-43	9.8-10.3
Distillate No. 2	8.8- 9.3
Diesel fuel, 48-52 d.i.	9.1- 9.6
Caribbean area (cargoes):	
Distillate No. 2	8.00

Residual Fuel (Bbl.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.70-1.80
Gulf Coast (cargoes):	
Bunker C fuel	2.10-2.20
New York Harbor (barges):	
Bunker C fuel	$2.47
Caribbean (cargoes):	
Bunker C	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.15

★ Denotes change from previous week.

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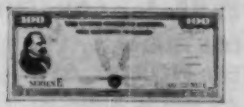

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1—8⅝ O.D. Landis Pipe Threading machine, size 2" to 8⅝" Serial No. REC195-3. Phil A. Cornell, Inc., 4200 West Reno, Windsor 3-4471 P. O. Box 5001, Oklahoma City 7, Oklahoma.

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2126CFM COOPER BESSEMER Two Air Cyls. 22½ & 14½ x 14" Stroke, Four Cyl. Engine, 400HP at 330RPM, 1942 Machines very good condition with a bargain price for the lot on East Coast.

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Boston & Haven St., Box 5203, Baltimore 24, Md.

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1—LATE MODEL 250 Watt General Electric Base Station—Transmitter—Receiver, Complete for Remote Control Operation. Used 60 Days. Rhodes Drilling Company, Abilene, Texas, ORchard 2-2839.

FOR SALE—28L Bucyrus-Erie trailer, mounted late model 50 tons tools to pick from, Bits from, Bits from 5" to 15", Dog house, light plant. Jack & H. P. Read, Phone 385, P. O. Box 205 Scottsville, Kentucky.

A LIMITED quantity Westinghouse 10 H.P., 1150 R.P.M., 3 phase, 60 cycle, 220/440V, high starting torque, totally enclosed, fan cool, oil well pumping motors reconditioned in our shop. $195.00 each for 1 to 4 motors, $175.00 each 5 or more, F.O.B. San Antonio. Loyd Electric Company, Inc., Phone CA 7-1309.

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FIELD OPERATORS (Refining)—Representatives wanted for field technical service. Must be experienced in all phases of refinery operations and free to travel. Send resume to: Box L-806, The Oil and Gas Journal, Tulsa, Oklahoma.

SERVICE MAN experienced on oil field engines and compressors to cover Mid-Continent area. State qualifications and salary expected. Box L-810, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER

Interstate gas transmission company has opening for graduate petroleum engineer with minimum of two years' experience for appraisal of gas reserves and availability. Position in main office, Houston.

TRUNKLINE GAS COMPANY
P. O. Box 1642 Houston 1, Texas

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Large oil company operating in Iraq has openings for a number of young engineers experienced in Drilling and Mud Control, and also in Reservoir work. Good salary and working conditions.

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A minimum of five years of practical experience in Drilling and Mud Control, or in Reservoir engineering.

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If you can meet these requirements and if you want a job in the Middle East, send full particulars to Box L-802, The Oil and Gas Journal, Tulsa 1, Oklahoma.

LEADING OILFIELD valve manufacturer desires sales representative to live in Casper, Wyoming and work Rocky Mountain Area. Salary, car, and traveling expenses furnished. Please furnish complete resume in first letter. Reply to: Box L-812, The Oil and Gas ournal, Tulsa, Oklahoma.

PLANT CHEMIST, to age 40, with at least 5 years refinery or gas processing plant experience. Must be capable of supervising laboratory for gas processing plant with catalytic reformer, and thoroughly familiar with gas chromatography and CFR knock machine. Location South Louisiana. Salary commensurate with experience. Submit summary of experience, recent photograph, and salary expected in first reply. Box L-804, The Oil and Gas Journal, Tulsa, Oklahoma.

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Graduate Mechanical Engineer with minimum of four years experience in petroleum refinery or related engineering. Will be responsible for mechanical design and cost estimate of refinery processing equipment.

Duties will be closely integrated with operation of a modern, independent refinery which includes crude distillation, catalytic cracking, polymerization, coking, hydrosulfurization, catalytic reforming, alkylation, and utilities.

Send complete resume of education and experience, including salary requirements. All replies confidential.

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St. Paul 1, Minnesota
ATTN: C. L. Dretzke

SUPERVISOR

Large Southern California independent oil company with modern refinery needs man to take responsible charge of all instrument and electrical maintenance work. Oil refinery maintenance experience desirable. Age 30-45. All replies confidential. Send resume of experience, qualifications and salary requirements to:

Personnel Manager
WILSHIRE OIL CO. OF CALIFORNIA
P. O. Box 2487
Santa Fe Springs, Calif.

HELP WANTED

Representatives wanted by manufacturer of production equipment for Rocky Mountain, Four Corners, Illinois, Michigan, South America and Mexico. Give list of accounts now handled and method of coverage. Box L-779, The Oil and Gas Journal, Tulsa, Oklahoma.

PIPELINE COST Estimator—full time, part time, or consulting. Reply to D.K. M., P. O. Box 35067, Dallas, Texas.

GEOLOGIST

Eastern investor in drilling deals wants geologist for screening and originating drilling deals. Full or part time. Send resume, compensation desired, etc.

BOX L-805
THE OIL AND GAS JOURNAL
TULSA, OKLAHOMA

PROCESS ENGINEER

Kerr-McGee Oil Industries, Inc. has an opening for a Process Engineer to join expanding Refinery Operations Technical Service Department. Minimum qualifications are BS degree in Chemical Engineering and five or more years experience in oil refineries. Send resume of education, experience and salary requirements to:

Refinery Division
KERR-McGEE BLDG.
Oklahoma City, Oklahoma

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HIGHEST PRICE paid for income royalties, overrides, oil properties. A. S. Berry, 109 Midco Bldg., 302 South Cheyenne, Tulsa, Oklahoma.

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NEED SMALL amount of Capital for Drilling Oil Well in Lincoln County, Wyoming. Will give good interest in Field for same: Phone SK-25440 or Box 236, Logan, Utah.

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DELAWARE CORPORATIONS formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

BUSINESS OPPORTUNITIES

BRITISH COMPANY, well established and with good connections in the Oil Industry is prepared to represent American or Canadian manufacturers of specialty products for the Oil Industry. A Director will be visiting U.S.A. and Canada in early May and would be available to undertake preliminary discussions. Box L-797, The Oil and Gas Journal, Tulsa, Oklahoma.

FINANCIAL Contacts, Underwriters, Private Brokers reached. No shopping. Confidential. Send details to Consultant—817—51st Street, Brooklyn, N. Y.

SITUATIONS WANTED

DRILLING ENGINEER—U. S. or foreign, B. S. Geology, 2½ years Venezuela, 32, married. Box L-794, The Oil and Gas Journal, Tulsa, Oklahoma.

WAREHOUSEMAN Materialsman: Age 35, married, 12 years Warehouse experience, Foreign & Domestic. Experienced Organizing, Administrative, Inventory Control, Personnel training, supervision and materials procurement for drilling and production programs. Box L-759, The Oil and Gas Journal, Tulsa, Oklahoma.

ADMINISTRATIVE secretary, 30, single, 10 years experience with major Venezuelan oil producer; desires relocate Latin America, but will consider other foreign employment. Box L-753, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES OR SALES Management: 18 years selling to drilling-production accounts, diversified equipment. Mostly Mid-Continent area. Management and administrative experience. Engineering background. Age 38. Presently employed. Box L-789, The Oil and Gas Journal, Tulsa, Oklahoma.

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CHEMICAL ENGINEER, 42, married. 8 years foreign pipeline and construction experience in Middle East and North Africa. 16 years experience in refinery operation and construction domestic. Desire managerial position for major contractor or oil company in foreign operations continent or Libya. Presently employed. Box L-793, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER (35) 11 years Midcontinent production experience. Box L-803, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGICAL ENGINEER, 28, married, 5 years exploration experience in Mid-Continent area. Box L-809, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST CAN keep one rig busy on gas prospects in North West Central Texas. Interested in retainer & override. Box L-808, The Oil and Gas Journal, Tulsa, Oklahoma.

LANDMAN—32—14 years experience including preventive management, promotion, public relations. Business & Legal education. Resume. Box L-811, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER: 3 years production and reservoir engineering with foreign operator, 1½ years analysis and programming for IBM 650 and 709 in missile industry. Good background in geology, geophysics, fluid mechanics, numerical analysis, matrix algebra, statistics. Single, age 31. Box 31 R 729, The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif.

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If you have a book manuscript or outline for a book on an oil industry engineering, operating or technical subject—we are in a position to help you get it published. Write briefly outlining what you have!

Write to—**L. B. Lofton**
THE OIL AND GAS JOURNAL
P. O. Box 1260—Tulsa 1, Okla.

LEASE AND DRILLING BLOCKS

FOR SALE: New 10 year term, 135 acre oil, gas and mineral lease, Shelby County, Texas, well located, priced $5 per acre, write for information. C. A. Parker, Box 507, Center, Texas.

FOR SALE or drilling interest: Arizona oil and gas leases (Federal), Coconino County, 640 acres T17N, R13E, 506 acres T17N. R14E. Write: Box L-708, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

NEW OIL Corporations—Will sell for stock or cash, oil and gas leases in Utah and Wyoming. Geophysical and Geological report on request. Will also assist in underwriting. Send resume of company to: Box L-807, The Oil and Gas Journal, Tulsa, Oklahoma.

3,500 ACRES $2 per acre. Lawrence County, Ky. in midst of new gas play. Ten year leases in first year, 1/8 override, no drilling committment, 50 cents per acre annual rental. U. S. Andersen, 8350 Santa Monica Blvd., LA 46.

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Denver 2, Colorado.

LEASE AND DRILLING BLOCKS

CAPITAL NEEDED TO drill offset, to production in Montgomery County, Kansas. Will definitely drill to Wilcox at about 1,100 ft. Will test Bartlesville at about 750 feet. Charley C. Murphy, Box 8, Cherryvale, Kansas.

PROSPECTIVE OIL Land: Suitable townsite acreage in fee, E/35 acres, Sec. 16, Block JKL, PSL Survey, Hudspeth County, Texas, at intersection U. S. Highway 62 and F. M. 1437 Highway, south of Dell City, Texas. Write quickly, Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

14 OIL WELLS, 5 water injection wells 560 acres. Production, approximately 20 barrels daily. 700 ft. depth. On pipeline. Engineers say drilling additional wells will make a money making, long lived flood. Southeast, Kansas. Box L-715, The Oil and Gas Journal, Tulsa, Oklahoma.

CUMBERLAND COUNTY, Kentucky—214 acres Kettle Creek, 10 year lease, $1.00 annual rental due April 1961. Has one old shallow oil well. Price $15.00 per acre. Cash $5,000.00. Oil payments from 1/8 plus 1/8 override. Inspection invited. Wire, phone, Luther L. Shepherd, Burkesville, Kentucky.

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ONE WELL PRODUCING about 5 bbls., 1,100 ft., Bartlesville Sand. 215 acres, more locations to drill. Gauge tank and make offer. Phone GI 7-4867, Tulsa, Oklahoma.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Billings, Montana. Notice is hereby given that 12,418.62 acres of land within five known geologic structures in the State of Montana and one known geologic structure in the State of North Dakota are offered for oil and gas leasing by competitive bidding. The structures, county in which located and area of land offered are as follows: RAGGED POINT field, Musselshell County, 240 Acres; GAS CITY field, Dawson County, 40 acres; KEVIN-SUNBURST field, Toole County, 2676.01 acres; CUT BANK field, Glacier County, 4.05 acres; BOWDOIN field, Phillips County, 9,420.04 acres, all located in Montana, and CEDAR CREEK field, Bowman County, North Dakota, 38.52 acres. The above lands will be offered to the qualified bidder of the highest cash amount per acre at 10 a.m. M.S.T., May 17, 1960, when bids will be opened. Description of the lands offered, details of the lease offering, how and where to submit bids, may be obtained from the Land Office, Bureau of Land Management, 1345 North 29th Street, Billings, Montana. Thomas H. Floyd, Jr., Manager, Land Office.

(Continued from page 201)

2134:1, TP 90 psi. TD 11,281 ft. New oil discovery.

SOUTHEAST NEW MEXICO

Eddy County:

John H. Trigg 2-28 Federal "B," 28-18s-27e, 2¼ miles east of Dayton field, 7 miles southeast of Artesia. IPP 18 BOPD, natural, open hole 1,618 ft. in Premier sand. TD 1,625 ft. New oil discovery.

Lea County:

Roger Harris 1 Federal, northeast part of county, 2 miles west of Crossroads in 20-9s-35e, 3 miles west of Bough field. IPP 100 BOPD, 18°, San Andres 4,800-80 ft. TD 4,887 ft. New oil discovery.

Central Montana plains discovery flows oil

Montana's Musselshell County on the central plains has a new Tyler "A" Mississippian sand discovery at American Climax Petroleum Co. and Lawrence Baker, Jr. 1 De Jaegher in C SE NE 31-11n-31e, 3 miles southwest of Ivanhoe field.

The well swabbed 11 bbl. per hour on test of perforations at 4,302-16 ft. Recovery on a drill-stem test at 4,306-28 ft. was 2,300 ft. of oil. The operators took the well to Heath at 4,635 ft.

New Map Available

The Department of Forests and Waters through a cooperative effort with the Pennsylvania Topographic and Geologic Survey has completed a map of the state designed to aid oil and gas operations on state lands.

The map has a scale of 1 in. equals 2½ miles. The base for the map is the USGS topographic 15-minute quadrangle series. This map of deep wells from Devonian on down was begun in 1955 under the direction of Alden W. Foster. Final work was completed under the direction of Hugh B. Montgomery, Chief of the Division of Minerals, Department of Forests and Waters. Topographic detail and the limits of the scale on the final map prevent all wells from being shown. All wells are shown where possible and where impossible the significant wells have been plotted.

The map is about 13½ ft. by 8 ft. There are 8 sheets of nearly equal size. It may be ordered from Pitt Photo Litho Co., Inc., 327 Fifth Avenue, Pittsburg 22. Price is $8.64 per set.

Pecos bags Ellenburger oil discovery in Texas

Ellenburger Cambro-Ordovician production was officially opened 26 miles east of Fort Stockton in Pecos County, far West Texas. The discovery well is Midwest Oil Corp. 1 University in Section 6, Block 20, University Lands Survey.

The operator completed the well on pump for 165 bbl. of 43°-gravity oil daily on a 16-hour potential test. Perforations were at 6,810-40 ft. and 6,862-95 ft. There was also indicated production in Wolfcamp, Connell, and Joins on drill-stem tests up the hole.

Prolific new pay found at Oklahoma discovery

Southern Oklahoma's North Dibble field, a one-well producer in McClain County, has a prolific flowing oil new-pay discovery in the Osborn-Pennsylvanian sand at 9,598-9,618 ft. Discovery well is Jones and Pellow Oil Co. 1 Sharp-Badger in C NW SE 16-7n-4w.

The well flowed 551 bbl. of 36°-gravity oil in 20 hours on 12/64-in. choke from the Osborn sand. Pay in the field, opened last winter, is the first Bromide Ordovician at 11,252-62 ft. That well flowed 50 bbl. in 6 hours on ¼-in. choke.

New book gives facts on fossils in Texas' Marathon basin

The University of Texas Bureau of Economic Geology has published a new research report describing Marathon basin fossils that will aid oil exploration teams in correlating geologic formations.

The fossils, called graptolites, occur in various regions, especially in the Ordovician rocks of the world.

"The Marathon basin in the Big Bend area contains the most complete sequence of Ordovician graptolites in North America," Dr. John T. Lonsdale, bureau director, said.

Dr. William B. N. Berry, now at the University of California, is author of the new publication entitled "Graptolite Faunas of the Marathon Region, West Texas."

"Berry's work establishes a standard against which other graptolite-bearing formations may be compared. Not only has he correlated graptolites in North America but he also connected the Marathon zones with similar zonal successions in Great Britain and Australia," Dr. Lonsdale explained.

The 179-page report, issued as University Publication 6005, contains detailed descriptions, photographic illustrations and an index map showing position of measured sections and collecting localities.

Copies, at $3 each, may be obtained from the Bureau of Economic Geology, University of Texas, Austin 12.

ADVERTISERS . . . in this issue

A

ACF Industries, Incorporated, W-K-M Division 23
Air-Maze Corporation 65
Ajax Iron Works 47
Aldrich Pump Company, The 54
Allis-Chalmers 14, 15
American Iron & Machine Works Company, Inc., Subsidiary of American Machine & Foundry Company 175
American Machine & Foundry Company, American Iron & Machine Works Company, Inc., Subsidiary 175
American Meter Company 29
American Recording Chart Co. 163
Anderson Company, The V. D. 187

B

B & W Inc. 169
Baker Oil Tools, Inc. 72
Bank of Montreal, The 74
Baroid Division, National Lead Co. 8, 9, 63
Bendix Aviation Corporation 21
Bethlehem Steel Company 168
Black, Sivalls & Bryson, Inc. 4
Braniff International Airways 39
Business Reports, Inc. 128

C

Caterpillar Tractor Co. 38, 85
Cathodic Protection Service 166
Chain Belt Company 24
Chase & Sons, Inc. 147
Chiksan Company 182
Classified Advertising 212, 213, 214
Computers, Incorporated 152
Cook, Machinery Co., Inc. 198
Cooper, Inc., Fred E. 60
Core Laboratories, Inc. 172
Crose Perrault Equipment Corp. 97

D

Daniel Orifice Fitting Company, Incorporated 64
Davison Chemical Company Division of W. R. Grace & Co. 37
Dover Corporation—The W. C. Norris Manufacturer Division 62, 193
Dow Chemical Company, The 67
Dowell 1, 170
Dresser Manufacturing Division 157
Drilling Equipment Manufacturing Co. 170

E

Equipment Engineers, Inc. 153
Ethyl Corporation 124, 125

F

Federal-Mogul Service Division of Federal-Mogul-Bower Bearings, Inc. 28
Fiese & Firstenberger Mfg., Inc. 150
First City National Bank 120
First National Bank of Shreveport, The 65
Fischer & Porter Co. 17, 18
Ford Motor Company 176, 177
Foster Wheeler Corporation 55
Foxboro Company, The 34, 35
Fuller Manufacturing Company 195

G

Garrett Oil Tools, Division U. S. Industries, Inc. 92
Gates Rubber Co., The 56
Geolograph Oil Field Services 194
Gorman-Rupp Company, The 192
Grace & Co., W. R.—Davison Chemical Division 37
Gray Tool Company 159
Grinnell Company, Inc. 7
Grove Valve and Regulator Company .. 43
Guiberson Corporation 36

H

H & M Pipe Beveling Machine Co. ... 154
Halliburton Oil Well Cementing Company 5, 89, 171
Hillman-Kelley 183
Houdry Process Corporation 127
Hudson Engineering Corporation 119
Hughes Tool Co. ..... Back Cover
Humble Oil & Refining Co. 3
Hutchison Manufacturing Company ... 189

I

International Harvester Co. 164, 165
International Paints, Ltd. 64

J

Jensen Bros. Mfg. Co., Inc. 188
Jo-Bell Products, Inc. 129
Jones & Laughlin Supply Division 184, 185
Jones Company, The S. M. 27

K

Kemp Mfg. Co., C. M. 46
Kidde & Company, Inc., Walter 66
Koppers Company, Inc.—Tar Products, Division 136, 137

L

Latex Construction Company 40
Liberty Manufacturing Company of Texas 13
Link-Belt Company 10
Lufkin Rule Co., The 187

M

Macco Oil Tool Co. 154
Magnet Cove Barium Corp. 179
Marathon Electric Manufacturing Corporation 25
Martin, Manufacturer, John N. 51
Martin-Decker Corp. 152
Masterseal Company 181
McKissick Products Corporation 20
Mid-Continent Supply Company 6
Minneapolis-Honeywell Regulator Co. 45
Mission Mfg. Company 58

N

National Airoil Burner Co., The 53
National Tank Company 216
National Tube Division 30, 31
Nelson Electric Mfg. Co. 128
Norris Manufacturer, W. C., Division of Dover Corporation 62, 193

O

Odex Engineering Co. 186
Oil Center Tool Co. 41
Oil Well Supply Division 2
Olin Mathieson Chemical Corporation, Chemicals Division 133
Orbit Valve Company 11
Otis Engineering Corporation 12, 100, 190

P

Pacific Pumps, Inc., A Division of Dresser Industries, Inc. 61
Paris Distributor, Inc., Henry H. 196
Penberthy Manufacturing Company, Division of Buffalo-Eclipse Corporation 167
Petroleum Contractors Corp. 198
Petroleum Electric Power Assn. 42
Pittsburgh-Des Moines Steel Company 33
Polyken Sales Division, The Kendall Company 144, 145
Powell Valves 50
Price Company, H. C. 70

R

Rector Well Equipment Co., Inc. 44
Reda Pump Company 153
Reed Roller Bit Company 68, 69
Republic National Bank of Dallas 186
Republic Supply Company, A Subsidiary of Republic Steel 191
Ridge Tool Company, The 198
Robbins & Myers, Inc. 158
Rockwell Manufacturing Company ..... Inside Front Cover
Royal Bank of Canada, The 48
Rust-Oleum Corporation 49

S

Sargent Engineering Corporation 103
Sauder Tank Co., Inc. 170
Sheffield Steel Division, Armco Steel Corporation 160
Smith Company, Tyson 162
Standard Tube Company 22
Stockham Valves and Fittings 52
Sumitomo Metal Industries, Ltd. 146

T

Taylor Instrument Companies 148, 149
Thompson Pump Company 65

U

United States Steel Corporation—National Tube Division 30, 31
Oil Well Supply Division 2
United States Treasury Dept. 211

V

Vogt Machine Co., Henry 32

W

Waukesha Motor Company 57
Well Equipment Mfg. Corp. 26
Western Supply Company 16
White Diesel Engine Division, The White Motor Company 19
Williamson, Inc., T. D. 147
W-K-M Division of ACF Industries Incorporated 23
Wyatt Industries, Inc., Wyatt Metal & Boiler Works Division Inside Back Cover

Z

Zink, Company, John 196

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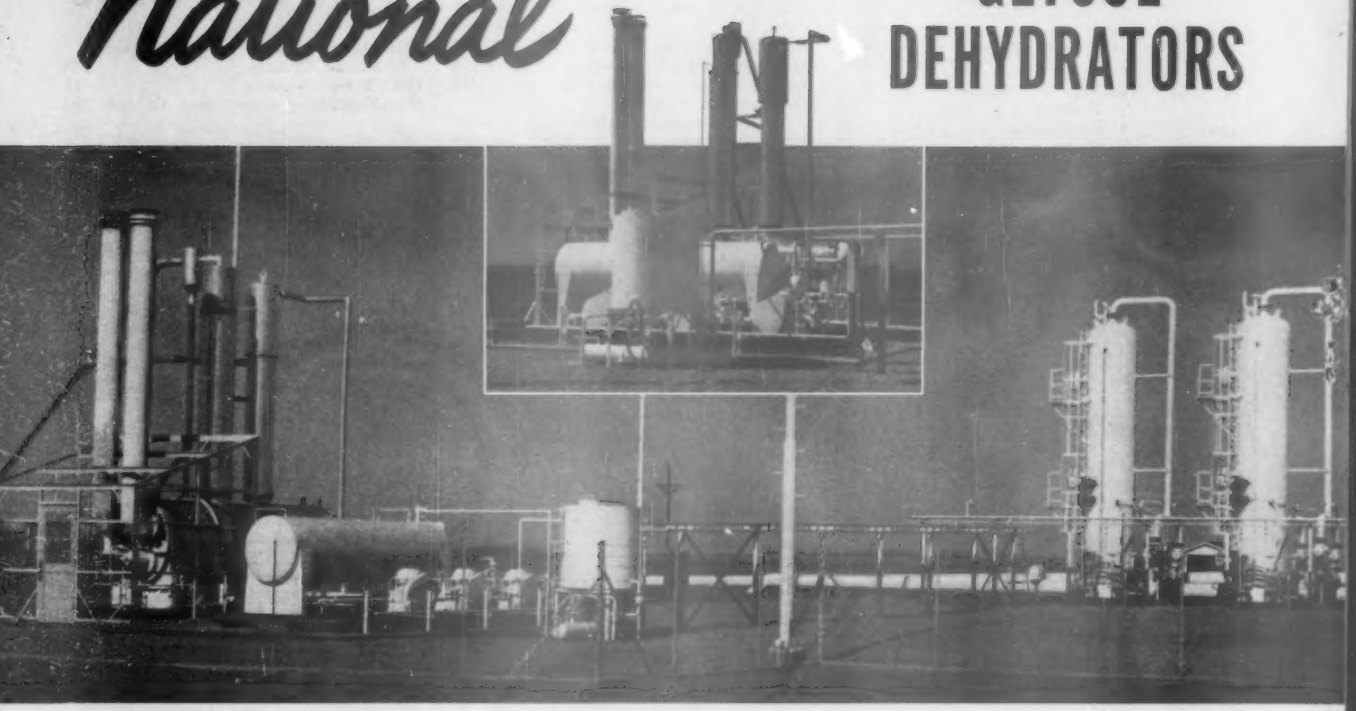

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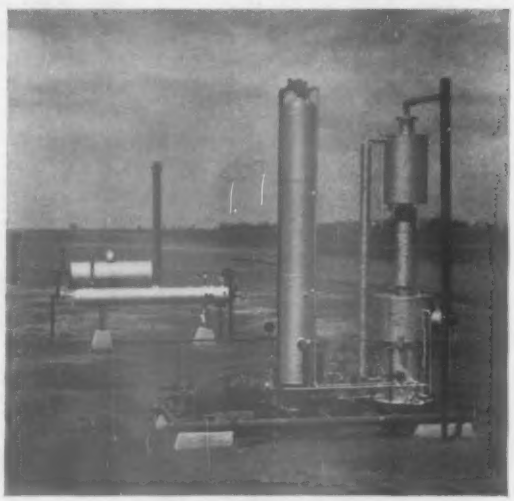

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